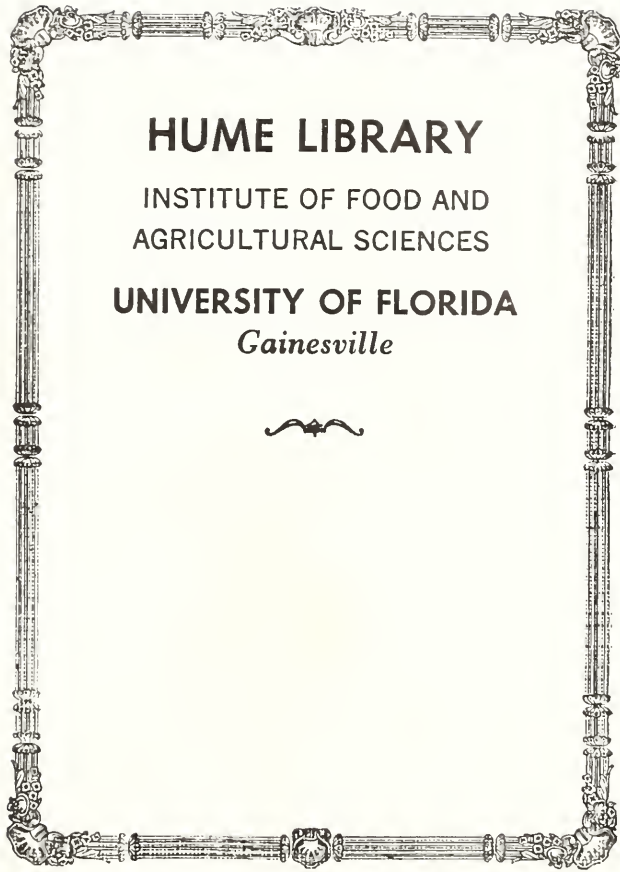




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A GAME INVENTORY OF ALABAMA

by

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PUBLISHED BY

ALABAMA DEPARTMENT OF CONSERVATION
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INTRODUCTION

The majority of the data presented herein was obtained during the course of an investigation under the terms of the PITTMAN-ROBERTSON ACT of 1937 (50 Stat. 917: 16 U.S.C. 669-669j). This legislation, known also as the Federal Aid to Wildlife Restoration Act, has as its primary purpose the checking of the rapid depletion of the Nation's wildlife resources (Day, 1939). To determine the status of Alabama's game resources and to find those species needing immediate attention, the Department of Conservation of the State of Alabama began, on October 1, 1939, a Pittman-Robertson project entitled *Inventory of Wildlife Resources of Alabama* (1-R). The necessity for such a project was stated in the original request by the Director of Conservation, State of Alabama, to the Secretary of the Interior in the spring of 1939 as follows:

“5. *Perspective*: At present little is known of the wildlife resources of Alabama, except in a very general way. Whether or not wildlife will increase, decline, or remain stationary under present conditions and management practices is a matter of speculation. It is known that because of certain factors, such as changing economic and social conditions, revised agricultural practices, lumbering, new population trends, improved transportation facilities, increase in posted lands, stimulation of outdoor sports, and malarial mosquito control, the status of most wildlife species is certain to be affected. Until the wildlife populations and environmental influences are catalogued and evaluated, a program of long range planning for wildlife restoration and management can be founded on nothing better than guess work. Information gained from the proposed study will disclose the status of the State's wildlife resources, adverse and favorable factors affecting them, and the measures which should be undertaken for restoration, management, and utilization.”

The project was expected to run for three years, but was terminated in June, 1942, because of the war. While the major objective was a determination of the present distribution and approximate populations of the more important game and fur-bearing animals of the State, information was also sought on all game species. Those given primary consideration were (a) the bobwhite quail (*Colinus virginianus*), (b) the wild tur-

key (*Meleagris gallopavo silvestris* Viellot), (c) the white-tailed deer (*Odocoileus virginianus*), and the Carolina beaver (*Castor canadensis carolinensis* Rhoads). It was desired to determine the following for each species of Alabama game animal:

- (1) Limiting Factors.—The lack of suitable habitat, land uses, economic conditions, predation, hunting pressure, and common practices affecting it.
- (2) Restoration.—The more important restoration possibilities for each species, including the environmental improvements, location and establishment of refuges, changes in agricultural practices, restocking, and revision of hunting regulations.
- (3) Research Problems.—The research work most badly needed to facilitate practical restoration and management.

The entire State was systematically surveyed, utilizing those geographic units which were the most practical for each species or for the type of census technique employed. Political subdivisions were frequently used while at other times advantage was taken of natural units such as soil provinces, river valleys, and mountain ranges.

Data were obtained by the following methods:

- (1) Direct observation and investigation by the project leader and his assistants.
- (2) Indirect methods such as questionnaires, talking with interested individuals, or through observations and investigations by the game wardens, farmers, landowners, local technicians, sportsmen's groups, and conservation clubs.
- (3) Search of the literature to obtain a background as an aid in interpreting the present ecologic conditions.

The project was initiated and carried on under the author's leadership until May 1941. It was continued under the super-

vision of Mr. George C. Moore until its cessation in June 1942. The personnel consisted of a project leader, four research assistants, a secretary, and from one to three part time assistants. When the results of the Inventory began to indicate needs for additional investigations and management practices, other Pittman-Robertson projects were begun.

This paper contains the results of our attempt to secure population data on the major game species and to determine population trends in the other forms. The majority of the techniques employed were not new, but all were modified considerably to fit Alabama conditions. None of these methods had, to my knowledge, been used on a state-wide basis in the Southeast prior to our survey.

Many of these techniques are crude and the results obtained cannot be considered mathematically accurate. I am aware of many of the shortcomings of the methods employed, but they were the best we could devise under the circumstances.

Each game animal is discussed in a separate section.

It is hoped that this study, imperfect though it is, will be a contribution to our knowledge of inventorying our wildlife resources.

ACKNOWLEDGMENTS

In an investigation of this nature the cooperation of many hundreds of individuals is necessary. To cite all persons making a contribution would be an arduous and lengthy task. I am limited to listing those to whom I am most indebted.

I am especially indebted to Dr. W. H. Burt, Curator of Mammals, Museum of Zoology, University of Michigan, for his numerous suggestions, helpful criticisms, and sincere interest. I am sincerely appreciative to Dr. W. W. Chase, Dr. Lee R. Dice, Dr. E. T. Hooper, Dr. C. D. LaRue, Dr. A. D. Moore, and Dr. Peter Okkelberg, of the University of Michigan, for their help.

To Mr. Bert E. Thomas, Director of the Alabama Department of Conservation, and Mr. C. Graham Hixon, Chief of the Division of Game, Fish and Seafoods, who approved the publication of this report and who generously allowed me to borrow the Game Division's research files, I am sincerely thankful.

I am grateful for the cooperation of my former associates, J. E. Herbert, E. C. Martin, R. J. Wheeler, Jr., and J. W. Webb who gathered the majority of the data contained herein, and Mr. George C. Moore who carried the research forward after my departure.

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I am grateful to my wife, Joan Barkalow, for her aid in tabulating the original data and her constant encouragement to complete this work.

THE BOBWHITE QUAIL INVENTORY

I. QUAIL POPULATIONS

The development of a state-wide census method which would give reasonably accurate results with the minimum expenditure of time and money was given first consideration by the personnel of the Inventory of Wildlife Resources project. The initial species selected was the bobwhite. The number of individuals hunting this bird is exceeded only by those hunting the rabbit (*Sylvilagus*) and gray squirrel (*Sciurus c. carolinensis*) which rank number one and two respectively in popularity. More money is spent on quail hunting, in Alabama, than on any other game species.

At the time of this survey the only previously attempted state-wide inventories for all game species, to my knowledge, were those of A. Leopold (1929, 1931) and Bennett and Nagel (1937). A. Leopold's 1929 paper was submitted to the Sporting Arms and Ammunition Manufacturers' Institute as an unpublished MS. and was not available. His 1931 report was a valuable guide and many of his basic principles were used in our work.

The quail census techniques finally selected were based entirely on our own experiences in the field and on suggestions obtained from many recognized authorities in game management.

DOG CENSUS FOR QUAIL

Experiences and Opinions of Other Investigators

Bennett and Hendrickson (1938) used an early morning dog census in late August and early September to obtain quail population data for the State of Iowa. We were unable to obtain reliable results in Alabama by using a single dog. No one dog that was tried had the ability to find all or even the same per cent of quail on two separate trials. A. Leopold (1931) had a similar experience in trying to obtain an index to the abundance of quail in the North Central States. He (*ibid*: 33-4) says,

"Three methods of measurement were tried out. The first was indirect. It proposed to use the number of

covies [sic] found per dog per day in various localities as an index to the abundance of quail. The resulting figures proved unsatisfactory. They expressed not only the abundance of quail, but also the ability of the dog and his handler, their familiarity with the ground, and especially the amount and distribution of cover. Some 'coveys per day' figures are given in Table D of the Appendix for what they are worth."

Bennett and Hendrickson (*ibid*: 171), in summing up their paper state,

"The writers do not claim that this kind of census is perfect, but from the standpoint of the Conservation Commission it has several good points. It is fairly accurate, and it is inexpensive, as only ten to twelve days are required for its completion, and only two hours a day are taken from the conservation officers' time. The results can be used as a basis for the opening or closing of the season in time for the dissemination of newspaper releases and official notices. Furthermore, the method can be quickly learned by any sportsman who has a well-trained dog and who is acquainted with quail and their habits."

They apparently excluded from consideration all travel time going to and returning from the census areas, the time taken by the warden to select such areas, and time caring for his dog. It was our experience in Alabama that these latter factors cost almost as much as, and sometimes more than, the period of actual censusing. We found it almost as expensive to work dogs for two as for six hours. The only difference was the cost of the handlers' time.

Errington and Hamerstrom (1936:323) in pointing out some of the disadvantages of using a dog in Iowa and Wisconsin state that

"A good dog cannot make up for lack of skill and diligence in the human observer. Skill in both dog and man constitutes the ideal combination, but of these two the skill in the man is more important. Indeed, it is our opinion that a truly skilled field man may make a better all-round 'bird dog' than the dog itself, despite the fact

that he does not have the dog's ability to find birds by scent."

This will not hold in the Southeast if limited to the ability to find quail. The experience of Bennett and Hendrickson (*loc. cit.*) seems to indicate that dogs were superior to field men in locating quail in Iowa during the early fall.

Experiences from our investigations bear out the conclusions of Stoddard in regard to high class shooting dogs. He says (1931:339):

"The accurate determination of the quail population of an area is very difficult in the Southeastern quail territory because of prevailing cover conditions and absence of snows. Observation of the performance of high class shooting dogs on many preserves has convinced us that under average conditions only a portion of coveys are found at any one search over the ground. This is particularly true of extensive woodland or 'cut over' tracts of uniform ground vegetation—the heavier and more uniform the cover, the smaller the proportion of the coveys located by the dogs.

"While a thorough search of an area with good dogs is of great value at times in census taking, differences of temperature and scenting conditions, duplications and omissions of coveys on the ground, and other factors operate to prevent this method being accurate for the study of quail populations."

At the beginning of the dog survey work, the proposed procedure was discussed with Mr. Stoddard and it was his opinion that it would perhaps give fairly accurate results. Our confidence in the technique employed was confirmed later.

Wight's (1931) strip survey method by use of a dog was of questionable value in Alabama and his statement (*ibid*: 555): "The bird dog's remarkable ability to scent game, however, is almost infallible in detecting the game bird's presence," was certainly not true of any of the more than one hundred different dogs used in our work or of any of the several hundred dogs I have observed work in the South. During the course of the inventory we were able to borrow many top-flight dogs and on

several quail preserves we observed some of the nation's best pointers and setters handled by Clyde Morton, Jake Bishop, Henry Banks, Geo. L. Harden, and others.

Watching many of America's finest dogs work on their home ranges, where the covey locations were known not only to the trainer but also to the dog, supplied sufficient evidence to substantiate our belief that even the best dog is far from infallible and that extreme caution must be used in trying to use data obtained from a one or two dog census.

A. Leopold (1937: 141) points out that "Indices are useful shortcuts, but they are of no avail, and may lead to dangerous fallacies, unless the variables which affect their validity are matched out or at least recognized." To use such indices as "Coveys (or birds) per dog per hour (or day)" in the southeastern part of the United States even with the "matching out of variables" is risky because the method gives unreliable results which have the appearances of being valid. To base a quail program on such an unstable foundation is to invite trouble.

Procedure and Experiences with Dog Census Methods

a. Inventory personnel dog census.

In the southeastern United States, a dog census will give exceedingly good results if some precautions are taken. Censusing during extremely hot, dry weather is particularly subject to error. To eliminate these errors it is frequently necessary to recheck parts of some areas two or more times.

The skill of the man handling the dogs has a direct bearing on the results of the census. If the dogs will not obey their handler large sections will be missed and unsteady dogs will flush birds thus making an accurate count impossible.

The following dog census method proved to be the most satisfactory. The number of dogs employed varied from three to five with four at a time the usual number. On rare occasions, due to uncontrollable circumstances, only two dogs were worked, but in such instances the land was covered at least twice. Three to five farms were censused in each county. The size of farms varied from 300 to 700 acres although it was some-

times necessary to employ larger or smaller units. The initial selection of farms was made by sticking pins in a state map in such a manner that they were spaced approximately equidistant and with each county containing at least three pins. The area was spotted on a county map and the nearest farm to that point was censused. The owner or tenant was encouraged to accompany the person making the survey because, in most instances, he was a valuable aid in locating the land boundaries. He was also a source of valuable information on changes in farm practices, hunting pressure, and other factors affecting the quail population. When the Personally Administered Questionnaire results became available, efforts were made to select farms on which "A" or "B" rated questionnaires had been obtained.

During the early stages of the census work, bird dogs were borrowed from local sportsmen who were encouraged to accompany the field workers. This plan was soon abandoned because it was not only difficult to secure dogs, but many hours were lost waiting for the individuals who were to accompany us. Borrowing dogs of the caliber desired was extremely difficult during the hunting season. This condition was alleviated somewhat by buying and training dogs for the work and by borrowing several good ones on a long term basis. We were forced, on occasion, to secure dogs locally when our own were exhausted or injured (this was especially true in working rough areas where it was sometimes necessary to use six or eight dogs a day). Pointers were used in preference to setters since pointers did not suffer as much from the early fall heat and there was no problem of removing burrs. The few setters employed were just as competent as the pointers and stood the work in briers better.

The ideal combination of dogs for census work was one close, two medium, and one wide "ranger." Good steady, shooting ("meat") dogs were the best for this work since they were essentially "trailers" who depended upon the scent left on the ground and vegetation rather than on the odor carried by the wind. A bird dog that depended upon the combination of "winding" to locate the general area of the birds and trailing them to their exact location made an ideal "wide" dog. Those least valuable for our work were the specialized, highly trained field trial dogs. These dogs being bred and trained to locate quail

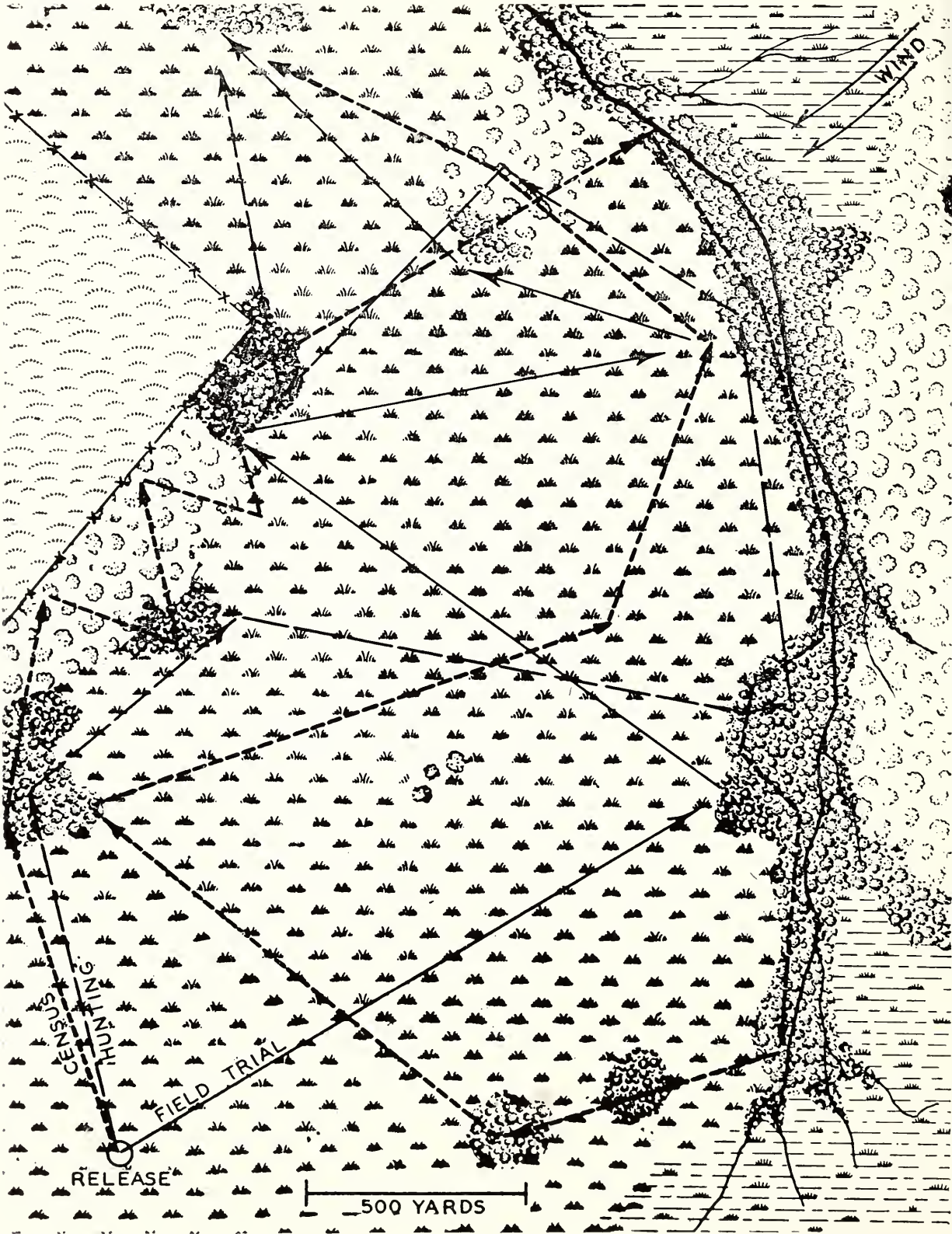


Figure 1

Differences in the working techniques of field trial, hunting, and census bird dogs.

by "winding" and to make long "casts" from one patch of likely quail habitat to the next tend to miss a great deal of unproductive terrain which must be worked in order to make an accurate census. It was not desirable to "cast" them through a thick woods or swamp because they usually went so far that it was impossible to see the area covered. Nearly all dogs owned by members of the project were out of the best field trial stock in the United States, but they were "held in" and soon became accustomed to covering the area in short "casts" and recrossing the large fields several times. When birds were scented the dogs were given time to "work them out" (locate them). High bred shooting dogs, while not as difficult to handle as field trial dogs, were still not as effective as good slow "meat dogs." Figure 1 will illustrate the difference in hunting techniques between the fast highly trained field trial dog, the good shooting dog who locates a running covey occasionally by trailing, and the type bird dog (the "trailer") most desirable for use in census work. Figures 2 and 3 illustrate the difference usually seen in the pointing technique between "meat dogs" and the highly trained field trial dogs.

An effort was made, by using dogs that were steady to wing, to flush each covey into a part of the area already covered thus eliminating the possibility of counting them a second time. No covey that was located off the farm being censused was counted even though it was only a few feet over the boundary. When a covey "went down together" into an uncensused area it was usually a simple matter to flush it the second time into a previously covered unit. If a covey "went down" as singles, any individual birds subsequently flushed in that area were disregarded. The QUAIL COVEY RECORD form (Appendix: 112) was filled out for each bevy located. The number of cocks and hens in the covey were recorded whenever possible.

On many preserves the number of coveys in a particular area was known and on two occasions census dogs were worked on such ranges. The located all known bevys the first time the area was covered; however, these samples were too small (totaling 400 acres) and hunting conditions too good to cite this as anything but minor supporting evidence of the reliability of the method.



Figure 2

Census dogs pointing a covey on the edge of an abandoned field.



Figure 3

Mr. George L. Harden, Supervisor of Mr. L. B. Maytag's estate, with two highly bred, excellently trained dogs of the "winding" type.

The major evidence on which we based our confidence in the dependability of the dog census was gained by working farms on which we knew the number and location of every covey. In the early stages of the project, farms were frequently checked two or more times to determine the covey ranges and to try various dog combinations.

On areas of known quail populations, we found that two dogs were able to locate a higher percentage of birds than a single dog. One experience is typical of the erratic results which can be expected from using a single dog. The farm worked had a known population of 6 coveys and the first day all 6 coveys were located; the next day conditions were apparently similar yet she was unable to find a single bird! The data obtained by covering an area once, using two dogs, was not considered entirely reliable. Three to four dogs were usually able to locate every bevy in a single coverage of a farm. When weather conditions were extremely dry, windy, cold, or wet the number of coveys found by the census dogs became erratic. We, therefore, discontinued any dog work during such unfavorable conditions. Dog censuses were begun in November of 1939 and 1940, but the fall of 1941 was so hot and dry that Moore



Figure 4

Coastal woodland areas such as this are extremely difficult to census.

(1942) could not begin before December 1. Censuses were continued the first two years until the coveys dispersed in April. Moore ceased dog work in March, 1942. The results obtained during the entire project are summarized in Tables II, III, and IV, and Figures 9 and 10. No data taken on quail shooting preserves or intensively managed refuges are included.

The early fall of 1939 was spent in trying different dog censusing techniques proposed by other workers. Our results indicated that none of these methods could be used to obtain reliable census data under existing Alabama conditions. The state-wide survey began in December 1939. The 9,250 acres censused averaged 11.7 quail per 100 acres. Many acres were checked two or more times, in order to verify our results. In 1940-41 we censused 53,143 acres from November 20 to April 12. It was hoped that data could be obtained on at least 100,000 acres during the 1941-42 season, but the war and drastic travel restrictions limited Moore's coverage to only 11,075 acres.

Summary of inventory personnel census.

As a result of three years experience, it was found that an accurate census could be made with three to five steady dogs of the trailing, or winding and trailing, type under the control of an experienced field man. Under extreme weather conditions (such as excessive heat, cold and high wind, dryness, or heavy rains) the method was not reliable. Under favorable conditions, at least 90 per cent of the quail on farm land could be found. This method when used in woodland (Fig. 4) or in the blue stem grass area (Fig. 5) of the coastal pine woods gives almost the same efficiency as on farm land, but requires from 25 to 50 per cent more time.

The accuracy of this method is also dependent upon the amount of time the dogs are given to work an area. Generally speaking, to cover more than 50 acres of "average" farm land per hour is compromising accuracy for speed. Because of the density of cover in Alabama it was out of the question to census an average of 100 acres per 1.023 hours as Crawford (1946) did in Missouri. In open land with few coverts we were able, at times, to census 100 acres an hour (Fig. 6).



Figure 5

Broomsedge and longleaf pine areas in the coastal region.



Figure 6

Poor quail range in the Black Belt near Montgomery. Such areas are easy to census, but must be covered as thoroughly as a good range.

b. Game Warden dog census, November, 1940.

During the dog census work in 1939, it became apparent that considerable difficulty would be encountered in furnishing the Department of Conservation accurate information on the success of the quail nesting season each year. To make an early morning census during September and October using the Bennett-Hendrickson technique was too costly and the vegetation too thick to work dogs satisfactorily. Since we were usually able to begin dog censuses after November 1, plans were made to use the wardens in a pre-season census. Many of them had been professional dog handlers and trainers before their employment by the Department.

The farms to be censused were selected by us and assigned by the district supervisors. Had we requested the wardens to select average farms, they would have picked medium class hunting areas which would have given much higher population figures than actually existed on truly average farm land. The reason for the selection of higher than average farm land is that a farm which contains an "average" quail population is considered by most hunters to be poor quail hunting range.

A copy of the instruction sheet and report form is included in the Appendix (pp. 113-4). Attached to them was a sheet divided into squares representing 20 acres each. The wardens were requested to sketch in the farm boundaries and to spot all the covey locations on it. This sheet served two purposes: it aided the wardens in keeping an accurate record of the position and number of coveys and it provided us with information on the coveys using "just off the area." It will be noticed that in the instructions (paragraph 5) we asked the wardens to show these "over the line" coveys on the map. All of them were eliminated from consideration in tabulating the results.

It was originally planned to complete all census work before the opening of the quail season on November 20. For that reason it was called a pre-season census (Appendix: 113). Inclement weather caused some delay, however, and a few wardens did not complete their assignments until December 1. November 15, 1940, was the date selected to make comparisons

since the bulk of census work was finished during the period from November 10 to 20.

Reports were obtained from 64 of the 67 counties. Sixty-three of these reports contained useable data. One county was omitted from tabulation since one covey found had the number of birds omitted. A total of 43,435 acres censused contained 347 coveys, totaling 4,828 quail. The average covey size was 13.91 birds and the concentration of quail was 11.1 birds per 100 acres.

When the results were tabulated, it was evident there had been almost no increase in the quail population during the past breeding season, but the data were not yet conclusive. It was possible that the areas sampled the previous season had been better than "average" and that the returns from the personally administered questionnaire work were also too high. Since we were unable to eliminate the above possibilities, it was impractical to recommend a shortened season.

Summary of game warden dog census, November, 1940.

There were only 4 of the 39 wardens who did not follow instructions. and whose results were not considered as good as those obtained by the inventory personnel. Many wardens were so interested in the work that they checked their assignments two or three times.

Several advantages to the Conservation Department come from making November warden censuses, for example, (a) they provide the department with the status of the quail immediately prior to the hunting season; (b) the success of the nesting season can be evaluated; (c) factual information can be given the sportsmen in time to make necessary adjustments in the length of the hunting season; (d) they give the wardens a broader view of game management problems; and (e) they improve warden-sportsmen relationships by placing the warden in the position of being a game conservation agent as well as being a law enforcement agent.

Advantages and Disadvantages of the Dog Census Method

Any technique that provides reliable population information on a state-wide basis is expensive and the dog census is

no exception. It is believed that this method is as economical as any that gives results of comparable accuracy.

One weakness of the census by the inventory personnel was the method of determining the date represented by the average population figure. This fault is eliminated if a census is completed in a month or less.

In addition to the quail population data obtained, information may be secured on covey sizes, sex ratios, farming practices, and other conditions of vital interest. For example, we secured sufficient information during the surveys to show that there was no valid biological reason for operating the quail farm. This information was a contributing factor in its discontinuance which saved approximately \$20,000.00 the first year; an amount in excess of the total cost of all quail censuses made.

PERSONALLY ADMINISTERED QUESTIONNAIRES, PART 1

Procedure

From April to November, 1940, a systematic survey was made by means of personally administered questionnaires. At least 25 farms in each county were visited by a member of the Inventory Project and forms similar to those on pages 115 and 116 were completed. The farms were selected from a county map, care being taken to pick those more or less equidistant from each other and also to cover the county completely; however, in areas of large unbroken woodland this was not possible. Farms of 40 to 400 acres in size were generally chosen for questionnaire work since the owners of such holdings usually had a better knowledge of the quail population than did those on larger tracts.

At the beginning of the survey information on both fall and spring quail populations was sought, but it soon became apparent that in the majority of cases only the spring estimates could be secured.

The number of coveys (including the number of birds in them) ranging off and on an area as well as those remaining permanently on the property were recorded. Each questionnaire was rated either A, B, or C by the interviewer. The A rating was given when the farmer was a bird hunter himself

and when he also appeared to have an accurate knowledge of the quail population on his farm. The B rating was assigned if the farmer had an apparently accurate knowledge of the quail coveys, but was not a hunter, and a C rating indicated that the data given were doubtful. No questionnaire was completed if it was evident that the information given was unreliable.

The following procedure was used in tabulating the results:

1. All C questionnaires were discarded.
2. The total acreage covered by the questionnaires was calculated for each county and also for the state as a whole.
3. The number of quail reported present on the farms was figured for each county and the county totals were used to obtain the state total.
4. The total uncorrected population of acres per quail and quail per 100 acres was calculated for the counties and the state using the following formulae:

$$\text{a. Acres per quail} = \frac{\text{Total number of acres in the area}}{\text{Total number of quail on the area}}$$

This figure is commonly but incorrectly termed "Quail per Acre" by the sportsmen.

$$\text{b. Quail per 100 acres} = \frac{\text{Total number quail on the area} \times 100}{\text{Total number of acres in the area}}$$

5. Corrected quail population calculations.

The number of quail reported to "use both on and off"* a farm and those remaining on the farm at all times were totalled separately.

The following formula was used to obtain the "Corrected" quail population on the farm:

$$\begin{aligned} \text{"Corrected" quail population} = & \text{Birds remaining exclusively on farm} \\ & + \frac{1}{2} (\text{Birds using on and off the area}). \end{aligned}$$

The "Corrected" quail population figures were then totalled for each county and the entire state. These totals were substituted in the formulae given in 4 above and the "Corrected Acres per Quail" and the "Corrected Quail per 100 Acres" figures were obtained.

*The word **use** is frequently employed in the Southeast to designate the whole or any part of an area occupied by quail.

Results

By use of the personally administered questionnaire method, 2,052 questionnaires covering a total of 788,713 acres of farmland were obtained (Table I). This is approximately a two and one-half per cent sample of the total farm land in Alabama. A total population of 109,315 birds was reported. Using these two figures, we obtain a calculated population of 13.9 quail per 100 acres (7.22 acres per quail). These figures are not considered accurate because (a) no consideration has been given to individuals that ranged off the farms and (b) 227 of the 2,052 questionnaires were rated as C. When all doubtful questionnaires are discarded, the average calculated quail density on the 1,825 farms is 15.4 birds per 100 acres (6.50 acres per quail) which is still obviously too high since birds both resident and nonresident on these farms are included. When the correction for quail using off the area is applied to the population reported on the 1,825 farms, a figure of 10.6 quail per 100 acres (9.48 acres per bird) is obtained (Fig. 7). These figures are believed to approach the average quail density in Alabama that existed at the end of the 1939-40 hunting season.

Extending the ratio of 9.48 acres per bird to the total of 19,661,415* acres (Anon.: 1938) gave an estimated population of 2,074,000 quail on Alabama's farmland at the end of the 1939-40 hunting season.

TABLE I

Data on completed Personally Administered Questionnaires

Total number of A, B, and C questionnaires obtained.....	2,052
Total number of acres covered by questionnaires.....	788,713
Average size of farms covered by questionnaires in acres.....	384.4
Average number of A, B, and C questionnaires per county....	30.6
Maximum number of A, B, and C questionnaires for any county	66
Minimum number of A, B, and C questionnaires for any county	25
Total number of A and B questionnaires obtained.....	1,825
Average number of A and B questionnaires per county.....	27.2
Maximum number of A and B questionnaires for any county..	59
Minimum number of A and B questionnaires for any county..	19

Approximately one thousand farms were visited on which no questionnaires were completed due to the obvious unreliability of the data being given.

*Based on the 1935 census of agriculture.

Comparison with A. Leopold's Questionnaire Method

The above procedure is somewhat similar to A. Leopold's (*loc. cit.*) third quail census method which he used in making the Game Survey of the North Central States. Our method differs from his in several important particulars. Leopold interviewed farmers and sportsmen, using only data from those who had an understanding of quail. Information was obtained on sample farms representing the best, poorest, and intermediate grades of abundance. He assumed fifteen birds per bevy when the exact number was not known. No farm smaller than 100 acres was accepted and 160 acres usually constituted his minimum. He apparently sought to minimize the error introduced by those coveys ranging off the sample area by using farms greater than 160 acres and assuming that the per cent error was the same for each. This assumption is probably permissible when the quail population data is to be used as frequency of density classes. This supposition cannot be made when the data are to be used in making actual population estimates. The effect on population figures, resulting from the assumption that all birds remained exclusively on our sample areas, can be easily seen from Fig. 7. where a ratio of 15.4

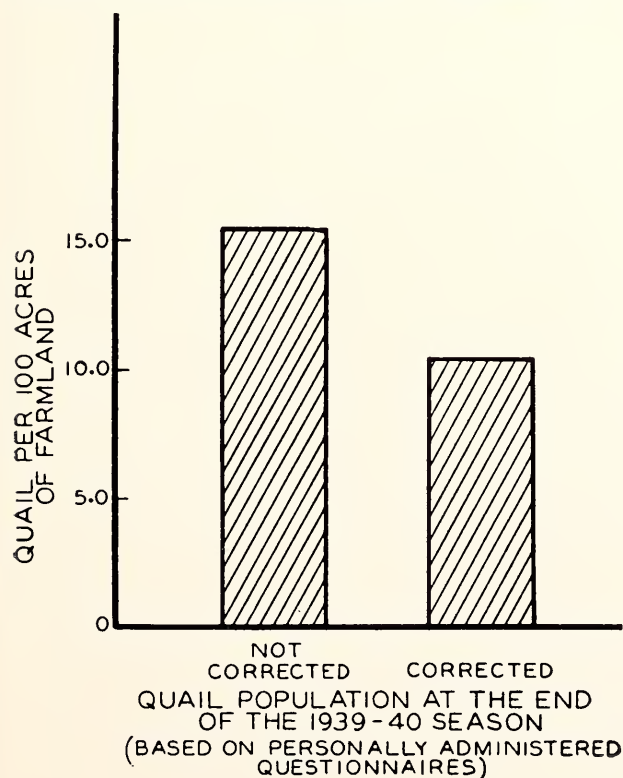


Figure 7

of 10.6 quail per 100 acres was obtained. The average size of our areas was approximately 384 acres. Leopold accepted only reliable reports from farmers and sportsmen, but was forced to depend on them to select his samples. Dr. Leopold points out that the weak point in this method is that sportsmen in good territory do not hunt poor ground and therefore could not give samples of it. Farmers supplied his poor sample estimates. This is a weakness, but a more se-

rious one would seem to be that he had to depend upon hunters to pick the good and the medium areas. It has been our experience that sportsmen will rarely hunt a truly medium farm and to depend on even the most reliable and conscientious individual to select from memory a good and a medium farm almost invariably results in obtaining too high a concentration for the medium area. Leopold was fully cognizant of this fault (1937:147), but did not attempt to evaluate it since the main object in his work was to compare quail densities with cover and food distribution rather than to enumerate the quail. For this reason it was not necessary to get a true "cross section" of the state as a whole. He arranged his data by "frequency of density classes" rather than averages and indicated that the latter were not worth much for measuring stands of game which always run from good to poor and are, in addition, likely to be misleading. His view on the use of "averages" has a great deal of merit. In our opinion the ratios obtained were far more useful for obtaining population figures and game trends than were breakdowns by "frequency of density classes." They are, in addition, considerably easier to calculate. It would be highly desirable to calculate the ratio of good quail producing areas to poor ones, but in order to secure valid figures for use in this computation all data must be taken over a short period. We had hoped to do this by using our preseason population figures obtained in the personally administered survey, but as pointed out on page 18 we could not get sufficient reliable preseason data. Areas which would fall into the highest density class in a preseason survey would, due to differential hunting pressure, probably fall into a middle or even a poor class at the season's end. Since our data were based on an end of the season estimate, the arrangement of samples into frequency of density classes would not furnish useable information. Questionnaires obtained from quail shooting preserves were not used in our calculations.

Weaknesses of the Personally Administered Questionnaire Method

There are a number of valid objections to the use of this method. The most serious weaknesses are:

1. The long period required to obtain the information made difficult the securing of accurate "end of the season" estimates of covey size.

2. Only questionnaires can be obtained for inhabited farms. There were a number of idle farms throughout the State on which information could not be obtained. In extending the figures to give a calculated population for quail at the end of the 1939-40 season it was assumed that the concentration on such uninhabited farms was not sufficiently different from the inhabited ones to change the state acres per quail ratio. Some evidence to support this assumption was obtained during the dog census work. Idle farms usually have a heavy concentration of quail for the first three to five years, then the population decreases. Since idle farms made up only a small per cent of the total farmland in the state, it was felt that little error was introduced by making this assumption.
3. This method is expensive, involving thousands of miles of travel and many man hours of costly labor. This questionnaire phase of the inventory project required almost 6,000 man hours and its total cost was approximately \$7,000.00. It would be even more expensive at the present time.
4. Trained men must be used in administering the questionnaires because the ability to question in an objective manner varies widely. By asking such specific questions as those enumerated on p. 24, it was believed that the interviewing differential among the research men was reduced to an insignificant factor.

Advantages of Using the Personally Administered Questionnaire Method

In spite of the weaknesses enumerated, it is believed that this method has a definite value in an inventory program because:

1. Large samples of the state can be covered and reliable population ratios obtained.
2. Information may be secured on all game species.
3. Problems arising from damage by beaver, deer, or bear can be discovered and frequently corrected on the spot.

The farmer was interviewed while actually on his farm. Rarely was one contacted away from it.

In many instances the occupant was asked to designate his land on the map and to spot in the covey ranges. This was frequently useful in determining whether the questionnaire should be rated **B** or **C**.

4. Current harmful farm practices can be readily ascertained and evaluated.
5. Farms can be located for quail food planting projects or for dog censuses.
6. The public relations benefit to the Department of Conservation is of considerable value.
7. It can be used to supplement dog census findings.
8. The designation of points on a map more or less equidistant and the selection of a farm as near to each point as possible, on which an **A** or **B** questionnaire could be obtained, largely eliminates the subjective selection of "average" or "typical" farms.
9. It eliminates the problem of evaluating each individual's opinion as to what constitutes a good, medium, or poor quail area.
10. In almost every instance it was possible to get the size of the coveys before the spring break up by asking the farmer, "How many birds did this covey have in it the last day you hunted them?" or, if he wasn't a hunter, "How many birds did this covey contain the last time you flushed them before they 'broke up'* for the nesting season?" This yielded figures closer to actuality than would have been possible by arbitrarily assuming a certain number of birds per covey when the number was unknown. When no figure could be obtained for the covey size the questionnaire was rated **C**.
11. Questionnaires were not accepted from sportsmen who were not farmers.

If the sportsmen owned a farm which was not open to more or less free hunting, the farm was considered

*Dispersed.

to be a private shooting preserve and therefore not typical of the conditions on the farm land where almost unrestricted hunting is allowed. The latter constituted the problem areas for the Department of Conservation and it was from such areas that data were desired.

DRIVE CENSUS

Lay (1937) considered a drive census in woodland superior to one made by dogs. In order to check the accuracy of our dog census method and to explore the possibilities of a drive, using CCC personnel, permission was secured to census Chewacla State Park (Webb and Segrest, 1941).

The 570 acre park was ideal for testing the ability of our dogs because the fields had been out of cultivation for 5 years and were densely covered with a mixture of blue stem (*Andropogon* sp.), greenbrier (*Smilax* sp.), dew- and blackberries (*Rubus* sp.), and sumac (*Rhus* sp.). Scenting conditions were unfavorable and it was almost impossible to keep the dogs in view.



Figure 8

Forming the line of drivers on Chewacla State Park.

Four coveys, totalling 49 quail, were found on the park and one covey of 15 birds was located just off the area in the dog census. All coveys were within a normal "cruising" distance of the park boundaries and it was apparent that none of them used the park exclusively.

A few days after the dog census, a group of (CCC) enrollees made a drive. They were spaced approximately 10 feet apart in a straight line (Fig. 8), which was divided into 3 squads of 10 men each. Every tenth man was designated as a squad leader and he kept the records. Research assistants were placed between adjoining squads to prevent a duplication of counts. Each of the drivers carried a stick with which to flush any "close-laying" game. Three bevys, totalling 32 birds, only two of which had been found by the dogs, were found by the drivers. The third covey had not been located in the initial census. Two coveys found by the dogs were not flushed by the drivers, but a later check with dogs found them just off the area. The third was also found to range off the park, and it is likely that it was off the area at the time of the initial census. Since the location of this one covey at the time of the dog census was uncertain, it could not be determined whether we located 100 per cent or 75 per cent of the population under these adverse conditions. It was relatively simple to locate all coveys with dogs after the first two censuses, but this was not considered an unbiased test because the covey locations were known and the dogs remembered their ranges.

Although the data obtained are reliable, the drive census is not practical for securing state-wide game populations because of the prohibitive labor costs. This drive required approximately 240 man hours as compared with 20 for the dog census.

UNMATED COCK WHISTLING INDEX

Stoddard's (*ibid.*) unmated cock whistling index is of considerable value in determining the summer quail population on large areas. In order to obtain accurate density indices from this technique it is necessary to know the sex ratio at the time of the census. Since the determination of such a ratio during the nesting season is impractical, it is necessary to use one

secured during the hunting season or immediately before the dispersal of the coveys in the spring.

Stoddard (*ibid.*) found that the sex ratio from bag counts was not the same as that obtained from trapping records even on the same area and at the same time. This was probably due to the less agile hens providing easier targets to gunners. He found that in netting coveys, the males were more adept at dodging the net than were the females. Hunters on quail shooting preserves are more apt to take only males than are the "average" hunters throughout the state, but even on the preserves this intentional selection of cocks by a few individuals did not produce enough males in the bag to furnish a true index.

During the course of the dog census it was found that the sex of birds flushed in open areas under good light conditions could be readily determined. The sex ratio in coveys not exceeding seven individuals could be determined accurately by the inventory personnel and also by the game wardens. Since bevys immediately prior to the nesting season will average less than 8 birds, reliable sex ratio data could be obtained from our spring Quail Covey Record sheets. Such a ratio is more nearly accurate than one obtained from bag counts because it is obtained at a later date and the differential kill of hens does not have to be evaluated.

From data taken during the Spring of 1940, we obtained a sex ratio of 100 hens to 115 cocks. This ratio indicated that if the number of unmated cocks whistling on an area is multiplied by 14, the approximate population of quail could be determined. The method was tried on a 710 acre farm with a known population of 65 birds prior to the spring dispersal. Four unmated cocks were found regularly from the first of June to almost the middle of July. Counts made prior to June were inaccurate because some mated birds were still whistling. The method gave a density of 56 individuals for the farm, which is reasonably close when the small size of the sample employed is considered. The results obtained on several other areas were of comparable accuracy.

This method was not employed to obtain data on a statewide basis, but it could be used for this purpose.

Summary of the Unmated Cock Whistling Index Method

Sex ratios obtained from dog census work will more nearly approach the actual ratio than those obtained from "bag checks."

Flushing ratios will provide as accurate an index as one based on a trapping ratio provided an experienced individual is making the wing counts.

The method has considerable value if the sex ratio is known. The use of small samples will not yield as reliable population figures as larger areas due to errors of sampling.

TABLE II

Census No.	Date	Quail/100 Acres (Farmland)	Estimated Number of Quail on Alabama Farm Land
I.	February 7, 1940	11.7	2,294,000
II.	February 20, 1940	10.6	2,074,000
III.	November 15, 1940	11.1	2,185,000
IV.	February 1, 1941	5.5	1,085,000
V.	January 30, 1942	8.7	1,708,000

RESULTS OF THE STATE-WIDE QUAIL POPULATION STUDIES

Tables II, III, IV contain the data obtained from the various census methods used during the three year period. Census numbers I, IV, V (Table II) are the dog censuses of the inventory personnel and census number III is the dog census made by the game wardens in November, 1940. Number II is the Personally Administered Questionnaire Survey.

The date assigned the population figure (dog censuses only) was that which would more nearly divide into half the total number of birds found.

Comparison and Evaluation of Census Results

a. Census I compared with Census II

The dog census by the inventory personnel indicated that the quail population on Alabama's farmland on February 7, 1940, was approximately 2,294,000 birds while the Personally Administered Questionnaire Survey gave an "end of the hunting season" (February 20) population figure of 2,074,000 birds. We do not have sufficient data on the 1939-40 season to extend the February 7 population data to February 20 in order to

compare the estimated figures obtained by the two methods. Data secured in the 1940-41 season indicated that the mortality during the last two weeks of the season was approximately 4 per cent (Barkalow:1948). If the rate of mortality during the last two weeks of the 1939-40 season was approximately the same as for the 1940-41 season, then the February 7 figure should be reduced by 4 per cent to bring it to the February 20 date. This would give an estimated population of 2,202,000 birds for the dog census compared with 2,074,000 obtained in the questionnaire work; a discrepancy of only 5.8 per cent.

TABLE III

Quail Hunting Season Dates	Census Periods On Farmland	Type of Census	Census By	Quail Per 100 Acres
Nov. 20, 1939 to Feb. 20, 1940	Dec. 1, 1939 to April 17, 1940	Dog	Inventory Personnel	11.7
— BREEDING SEASON —				
Nov. 20, 1940 to Feb. 20, 1941	Nov. 1, 1940 to Dec. 1, 1940	Dog	Game Wardens	11.1
	Nov. 20, 1940 to April 12, 1941	Dog	Inventory Personnel	5.5
— BREEDING SEASON —				
Dec. 1, 1941 to Feb. 20, 1942	Dec. 1, 1941 to March 31, 1942	Dog	Inventory Personnel	8.7

TABLE IV

Census Season	Census By	Type Area	Acres C'nsus'd	Quail Found	Coveys Found	Birds/ Covey	Acres/ Quail
Dec. 15, 1939 to Apr. 17, 1940	Inventory Personnel	Farms	9,250	1,079	-----	-----	8.57
— BREEDING SEASON —							
Nov. 1, 1940 to Dec. 1, 1940	Game Wardens	Farms	43,435	4,828	347	13.91	9.00
Nov. 20, 1940 to Apr. 12, 1941	Inventory Personnel	Farms	53,143	2,933	313	9.37	18.12
January to April, 1941	Inventory Personnel	Woods	5,338	57	7	8.01	93.65
— BREEDING SEASON —							
Dec. 1, 1941 to Mar. 31, 1942	Inventory Personnel	Farms	11,075	962	85	11.32	11.51

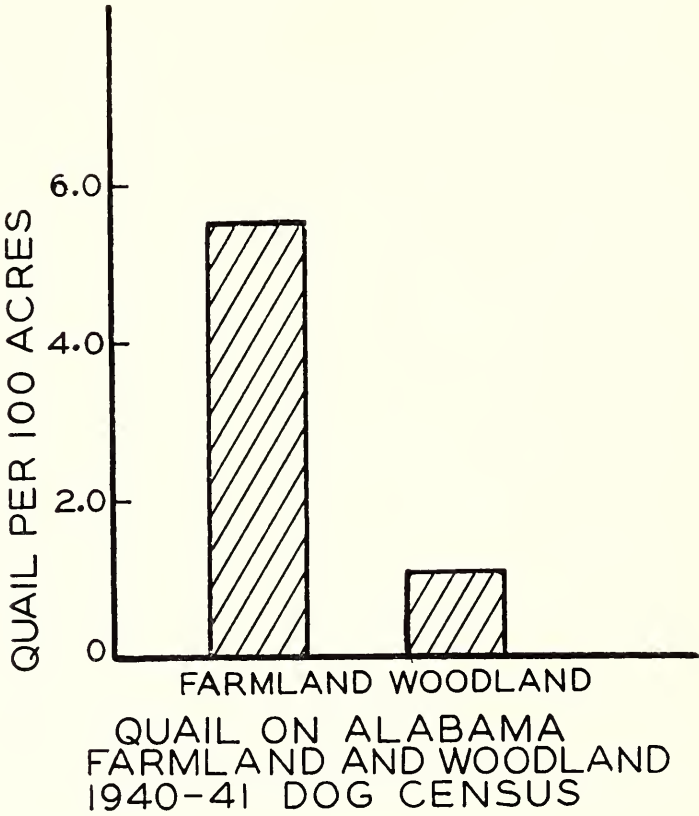


Figure 9

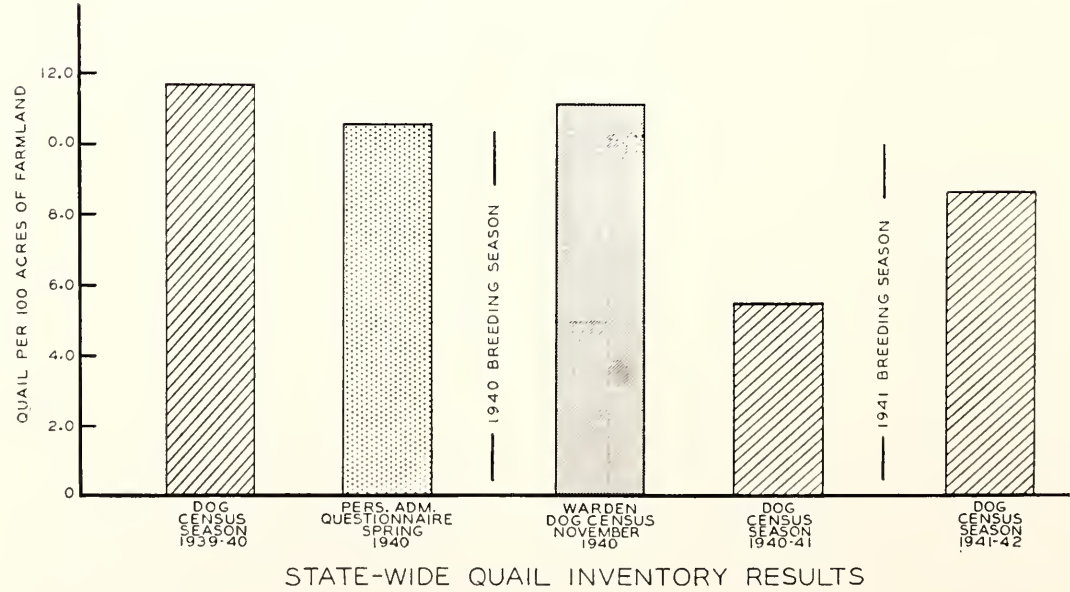


Figure 10

b. Censuses III and IV

The November, 1940, census made by the game wardens was probably nearest to accuracy of the five. It appears, from the estimated figure of 2,185,000 birds on the farm land at the beginning of the hunting season, that there was but a small increase in population during the nesting season. This presented several questions.

- (a) If the figure of February 7, 1940 was accurate, had the population been shot down during the last two weeks of the season?
- (b) Was the February 20, 1940 figure of 2,074,000 too high?
- (c) Was the warden census figure too low?
- (d) Were the figures obtained by censuses I, II, and III reasonably accurate and had the nesting season been almost a complete failure?

We knew that there had been a considerable amount of rain during the early part of the 1940 nesting season in certain sections of the State and that during the summer other sections experienced a drouth, but at the time these conditions did not seem to be unusual. It was not long before evidence of a drop in the quail population began to accumulate. Our dog census results were indicating that fewer birds were present per unit area this year than in 1939-40 and the sportsmen began to complain in no uncertain terms that quail were "off." Considerable pressure was brought to bear on the Department for closing the quail season on February 1. This request had some merit, but our own data at that time was not complete enough to present a convincing argument either way, so the season remained open. An article was published in the March issue of the Department's magazine explaining why the season was not closed. When the final results of our work had been tabulated, there was an estimated population of only 1,085,000 birds as of February 1, 1941. This figure is almost exactly 50 per cent of the population found as of February 7, 1940. It was concluded that all of our censuses were reasonably accurate and the nesting season had been an almost complete failure. The evidence relied upon to reach these conclusions were: (a) The re-

sults of Census IV taken at approximately the same time the previous season indicated a 50 per cent reduction over Census I. (b) The farmer's opinion obtained by the personally administered questionnaire survey of the quail trend, which reflected the summer population of quail, indicated a decrease. (c) The Warden Game Trend Questionnaire rating of -20 (Figs. 13, 14). (d) The close agreement between Census I and Census II figures seemed to indicate that they were fairly reliable indices of the actual population. (e) If the figures from censuses I and II are accurate, and had there been a normal nesting season, a November population of approximately four million quail should have been reported; whereas, the wardens found only 2,185,000. (f) We knew that the weather had not been "average," although we were unable to evaluate its effect at the time of the nesting season. (g) The great increase over the usual number of sportsmen's complaints left little doubt in anyone's mind that a decrease had occurred.

The following recommendations were submitted to the Director of Conservation on March 10, 1941.

Recommendations For the Quail Season in 1941-42

Memorandum to: Mr. Albert W. Gill
Mr. Ben C. Morgan
Mr. J. M. White
Mr. Neilsen B. O'Rear
Mr. Tom Ford

Investigation by the Inventory of Wildlife Resources of Alabama Project had shown the quail population over most of Alabama to be lower, except in the Black Belt, than usual this year. This decrease has been due to a number of interrelated factors, no one of which can be said to have been active over the entire State. Generally speaking, however, the past two nesting seasons have been partial failures due to inclement weather at the hatching peaks. The severe cold in January, 1940, undoubtedly affected the quail population in North Alabama. The increase in predatory fur animals due to poor fur prices has also contributed to the failure of the quail population to produce a satisfactory shootable surplus.

Since it will probably require two years for the quail population to recover from the natural winter losses and the winter

hunting kill, it seems necessary to make the following recommendations.

1. Reduce the bag limit from twelve birds to ten per day.
2. Shorten the season twenty days. A season from December 1 to February 10 would be considered ideal.
3. The reduction in bag limit and the shortened season to be effective for one year only.

It is believed that if a satisfactory nesting season is experienced this year that by the 1942-43 season the quail population will be recovered enough to extend the season and increase the bag limit.

Respectfully submitted,

Frederick S. Barkalow, Jr., Senior Biologist
Inventory of Wildlife Resources Project

March 10, 1941

c. Census V

Since the 1941-42 census was necessarily curtailed, Moore and his assistants worked only a few of the areas which had been selected and censused the previous year. They found approximately a 58 per cent increase in the quail population over the previous season. This was supported by reports from numerous sportsmen throughout the State and was definitely reflected in the Warden Game Trend Questionnaire. A plus 62 rating (Fig. 13) indicated that there had not only been an increase, but that it was general throughout the State. The value 62 has no quantitative significance (p. 36).

Summary of the Results of the State-wide Quail Population Studies

Dog census results indicated that there had been a 53 per cent decrease in the February, 1941, quail population compared with that of February, 1940 (censuses IV and I respectively). There was an increase in the January 30, 1942, figure of ap-

proximately 58 per cent over that of February 1, 1941 (censuses V and IV respectively). The population as of January 30, 1942, was still approximately 26 per cent lower than that of February 7, 1940 (censuses V and I respectively).

Returns from the Personally Administered Questionnaires (Census II) were in close agreement with the results of the 1939-40 dog census (Census I).

II. QUAIL TRENDS

Fluctuations in the quail population were determined by Personally Administered Questionnaires, Part 2, and by Warden Game Trend Questionnaires. These questionnaires were not limited to securing information on quail trends alone, but included all game species. Since the methods and procedures discussed below were the same for all forms, they will not be repeated in other sections.

PERSONALLY ADMINISTERED QUESTIONNAIRE, PART 2

Procedure

The second page of the Personally Administered Questionnaire was designed to test the feasibility of (a) obtaining the trends in the game population, (b) to determine if any agreement could be expected between the questionnaire trend reported by the farmers and that obtained from the game wardens, (c) to plot the occupied range of the larger game species, and (d) to obtain estimates of the large game populations.

After the Quail Survey Sheet (p. 115) had been completed, the form on page 116 was filled in. The Annual Kill, Estimated Population, and Absent columns were designed for recording data on the larger game species.

The opinion of each farmer concerning the game trend on his farm was obtained by asking the question, "Comparing this hunting season (1939-40) with last year's (1938-39) do you think the number of deer (quail, etc.) was (a) greater, (b) the same, or (c) less?" The farmer's answers were indicated by checks in the proper column and the questionnaire

rated by circling the proper letter A, B, or C at the bottom of the form. Only those classified as A or B were used in the final evaluation of the questionnaires (except quail, turkey, and deer).

When each county was completed, a report of the results was prepared. The one submitted on Baldwin County, Alabama (Appendix: 117-23) is typical. On page 122 of this report is a summation of farmer opinion concerning the trend of each game species in Baldwin County. The trend was obtained by subtracting the number of reports of "Less" from those reporting the species as being "More Numerous." If a negative figure resulted, the trend was given a -1 rating; conversely, if a positive result was obtained the county was given a +1 rating. Table XII, Columns I-IV, on page 125, contain a tabulation of county trends. Column V of the table is the State trend for each species.

Only one Personally Administered Questionnaire survey was made because the dog censuses and Warden Game Trend Questionnaires furnished essentially the same information at a lower cost.

WARDEN GAME TREND QUESTIONNAIRES

Procedure

At the end of each hunting season a game trend questionnaire blank (p. 116) was sent to each warden. Accompanying it was a sheet containing the following instructions:

"Attached is a game abundance questionnaire for the hunting season just passed. Please fill out this form and return at your earliest convenience.

"Use a separate blank for each county or part of a county in your territory. In other words, if you work Lee, Chambers, and Russell Counties fill out a separate blank for each. If you work half of Lee and half of Russell then you should fill out a blank for the half of Lee that you work and another for the half of Russell in your territory."

The trend for each species was determined by the same procedure used in the Personally Administered Questionnaire survey. Table XIII on page 126 contains a breakdown, by species, of trends over the three year period. This method is based upon the premise that the increase reported for one county is of the same magnitude as a decrease reported for another. It is obvious that the figures obtained have no quantitative significance. Factors causing a change of sufficient magnitude to be observed in a game population usually operate throughout a wide area and local influences effecting an opposite trend in one or two counties are not sufficient to obscure the general picture. For this reason it is believed that valid trends can be obtained from warden questionnaires for those species which are relatively uniformly distributed throughout the State. By mapping the reported trend in each county it can be determined whether the state-wide result was caused by changes in a group of adjacent counties or from several counties scattered at intervals throughout the state. This plotting must be done in order to interpret correctly the significance of the rating when a serious decrease has occurred in one half the state, but an increase occurred in the other. The two quail trend maps, Figures 11 and 12, illustrate these points. Figure 11 shows a decrease in the southwestern part of Alabama, while the population was increasing in the northern and northeastern portions. The next season (Fig. 12) the decrease in the quail population was state-wide.

Local concentrations of a species must be considered; for example, in the case of waterfowl, 80 per cent of the population winter within the boundaries of only 10 or 12 of the 67 counties. During the period of our investigation, it was possible to assume all waterfowl county reports to be of equal value, since the resulting trend in all 67 counties when considered together was no different from that exhibited by those counties with the highest concentrations. The decrease in wintering birds was widespread and even in counties with a normally low waterfowl population, this reduction was noticeable.

Care is also necessary in interpreting the population trends of turkey, deer, bear, beaver, and otter as these species are not uniformly distributed throughout their range or the State. The state-wide trends obtained for these species were no different when all reports were assumed to be of equal value from those

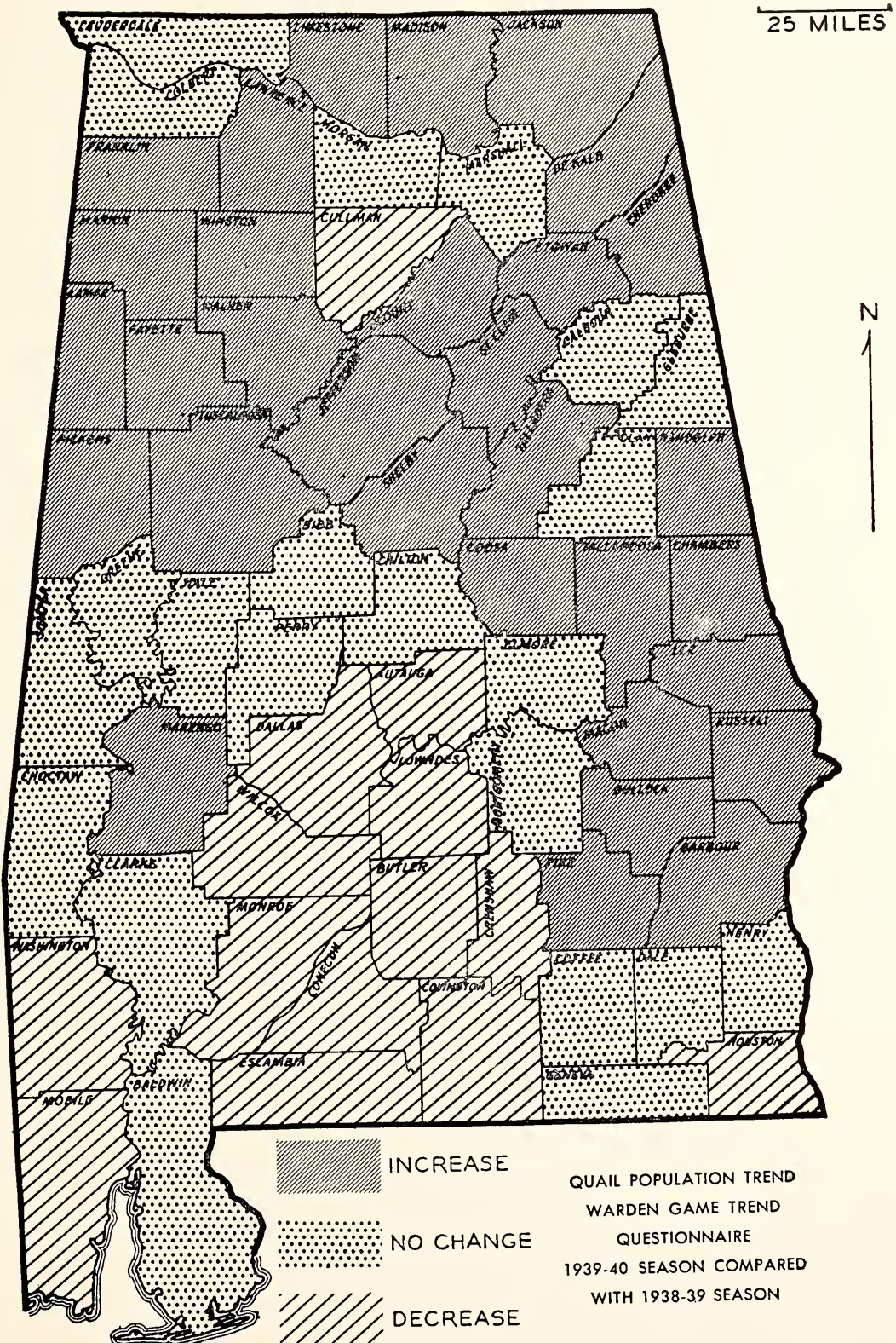


Figure 11

trends obtained from counties with the great bulk of the population. This may have been a coincidence. The following conventions were used in all game trend graphs. The hollow circle (○) is the net county value of the 1939-40 season compared with the 1938-39 season. The half-shaded one (◐) is the 1940-41 season compared with the 1939-40 and the black dot (●) is the 1941-42 season compared with the 1940-41. The first point (○) has the same value on the graph as the second column of Table XIII on page 126. Point two (◐) is obtained by adding algebraically the 1940-41 value to the 1939-40 result. Point three (●) is the 1941-42 value added algebraically to the value of point two. The vertical distance between any two adjacent points will give the net number of counties reporting an increase or decrease for the one season compared with the other.

QUAIL POPULATION TRENDS

In comparing the 1940-41 quail season with that of 1939-40, 20 more counties reported a decrease than an increase. When the 1941-42 season was compared with the previous one, there

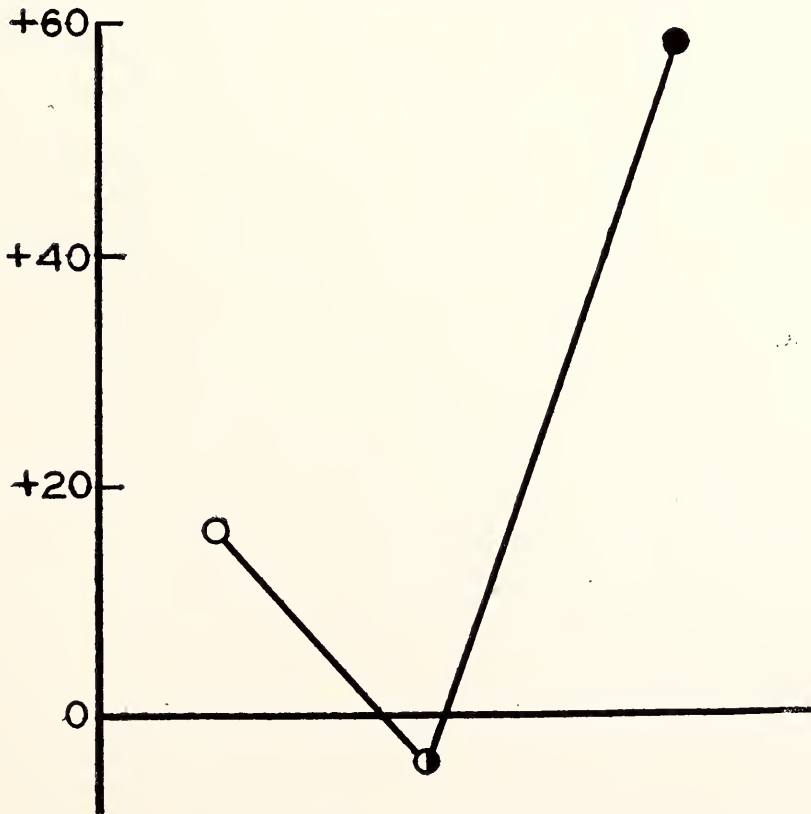


Figure 13
Warden opinion of quail population trends.

were 62 more counties in which an increase was reported than a decrease. These data would indicate that the population was lower in 1940-41 than it was in 1939-40, that the 1941-42 population was greater than that of 1940-41, and that the increase in population had been almost statewide in 1941-42. These reports were confirmed by our census figures which showed a concentration of 11.7 quail per 100 acres in 1939-40, 5.5 quail per 100 acres in 1940-41, and 8.7 quail per 100 acres in 1941-42 (Fig. 14).

The Personally Administered Questionnaire returns for quail was -5, whereas, the warden returns gave a +16 figure when the 1939-40 season was compared with that of 1938-39. This point is discussed in the following section.

DISCREPANCIES BETWEEN THE QUESTIONNAIRE METHODS

If column V of Table XII (p. 125) is compared with Column II of Table XIII (p. 126), it is seen that the reports on quail, turkey, deer, dove, and rabbit do not agree. The first three species cannot be compared accurately since the figures in the Personally Administered Questionnaires may have been influenced by having included C questionnaires in the trend tabulation. There is a probable explanation for the disagreement between the rabbit, dove, and quail reports. The Personally Administered Questionnaire data were obtained in the spring and summer, and the farmers may have been influenced by the normal spring increase in the rabbit population. The same is true for the dove, but in an opposite direction. The dove population dropped drastically in 1941 and the obvious decrease in the number of resident birds could be seen in the spring by the farmers after the migratory birds departed; this probably influenced the farmers' opinions. The wardens, having reported a net 17 county increase in the wintering population of doves at the end of the 1939-40 season over the previous season of 1938-39, were probably correct. The decrease in the quail population as reported by the farmers is also possibly a summer population report rather than an end of the season one. There was almost no increase in the quail population during the spring and summer of 1940 due to inclement weather. Results of the warden's November dog census tend to confirm this fact.

The above explanations may possibly account for the apparent discrepancy between the warden reports and those of the farmers. Where there was a disagreement, we believed the warden's opinions to be the more nearly correct because they are more accustomed to thinking in terms of increase and decrease. Farmers can give valuable information on such

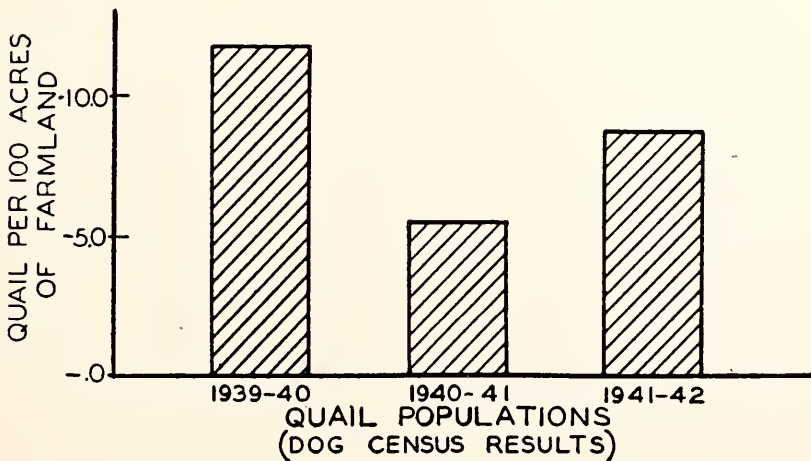
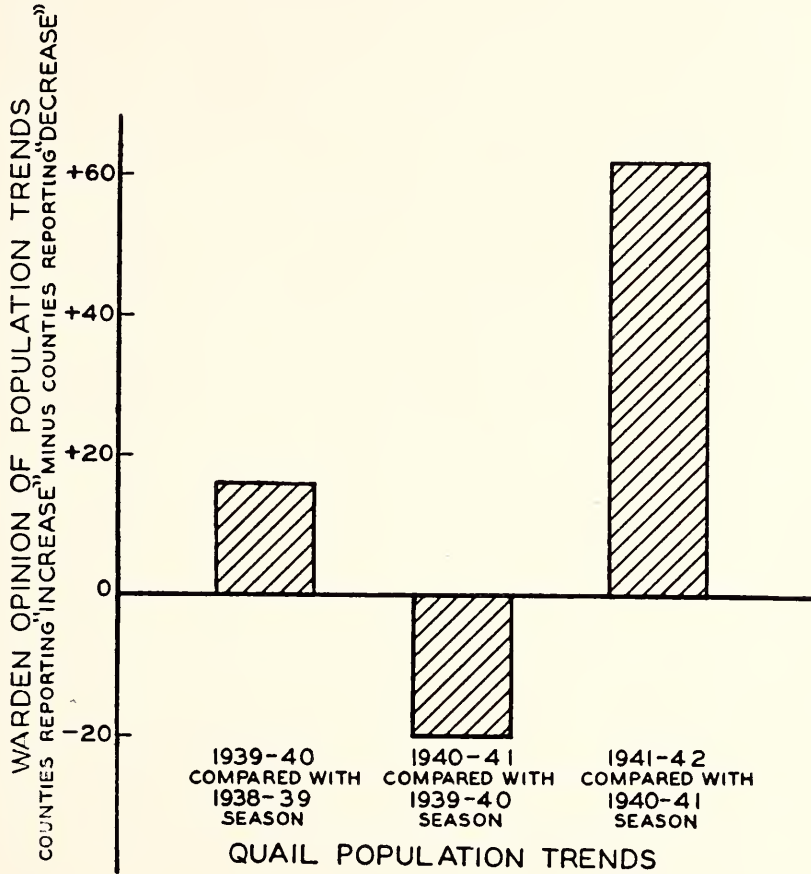


Figure 14

exact questions as the location and range of a covey of quail, but they are not accustomed to thinking in terms of increase or decrease of game species or of annual fluctuations due to winter loss and reproductive increases. Our Personally Administered Questionnaire returns may reflect this lack of appreciation of seasonal variation and may also be influenced by a lack of experience in evaluating trends from one year to the next. The warden reports were submitted before the spring departure of the migrant doves, the seasonal increase of the rabbit population, and the unsuccessful quail nesting season. The discrepancy in the turkey figures is not considered significant. A. Leopold discussed his experience with surveys of opinions of quail trends in the North Central states and concluded (*ibid.*: 41) that, "Observers competent to give specific population samples are ordinarily incompetent to judge of long-time trends." We had similar experiences in Alabama. In many instances we felt that we did not get a valid opinion of the trend from the previous to the present season. Leopold considered the long-term quail trend information obtained from Ohio wardens to be poor. We made no attempt to get warden opinion of the long-time trends. Our problem was carefully explained to them and it is believed that their opinions of the change in population from one season to the next was, in nearly all cases, valid. Our data seems to confirm this opinion. It could not be definitely determined whether the discrepancies between the farmer reports and those of the wardens were real or whether a summer figure rather than an end of the season estimate from the farmers altered the results. We were of the opinion that the latter was the case.

SUMMARY OF QUAIL TREND METHODS

Trends were obtained from both Personally Administered Questionnaires and Warden Game Trend Questionnaires. The latter is considered the more reliable. No effort was made to secure information on long-term trends from either the farmers or the wardens.

It is necessary to plot each reported county trend on an outline map in order to properly evaluate the returns obtained from either method. Care must be used in interpreting trends on species not uniformly distributed throughout the State.

The fluctuations in the quail population reported by the wardens were confirmed by the dog censuses.

THE WILD TURKEY INVENTORY

I DISTRIBUTION AND POPULATION ESTIMATES

PROCEDURE

The distribution and population estimates were obtained largely from data secured during the Personally Administered Questionnaire survey. These data were supplemented by information from the game wardens and limited field observations by the inventory personnel.

During the questionnaire work, turkeys were recorded as present on a farm if they had been seen within the past 6 months. It is obvious that, because of the scarcity of farms, a complete coverage of the turkey range could not be obtained by this technique alone. As an aid, we asked each game warden to plot the distribution of this species in his district. Two maps for each county were drawn up, one from the warden's data and one based on the questionnaire reports and supplemental information gathered by the inventory personnel. In almost every instance the two maps coincided closely. A final map was then drawn for each county (Fig. 15). When all county maps were completed, a composite one was made for the State (Fig. 16).

Turkey flocks are quite conspicuous (Fig. 19) and in several instances we obtained accurate information on the number and size of each flock in a particular range. Population estimates were made by extending data obtained on such areas to the entire occupied range in that section of the State. Such a procedure is possibly not as reliable as that of Mosby and Handley (1943), but the primary objective was to secure general information on the distribution and populations to provide a basis for later work. Moore and his assistants made the detailed survey during the summer of 1941. Each of the previously reported ranges was visited and the boundaries determined (Figs. 17, 18).

Population estimates were obtained by the Mosby-Handley (*op. cit.*) technique.

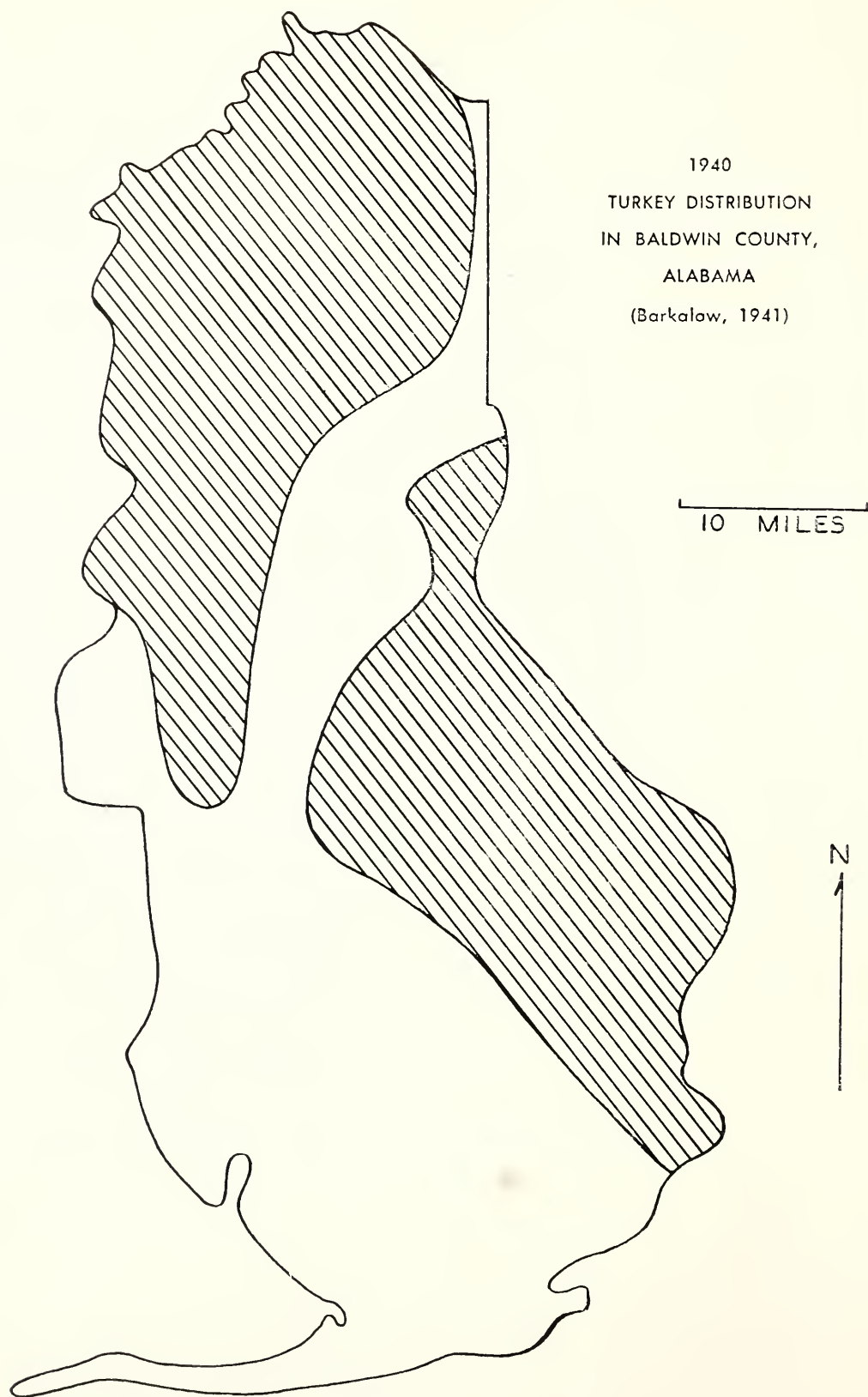


Figure 15

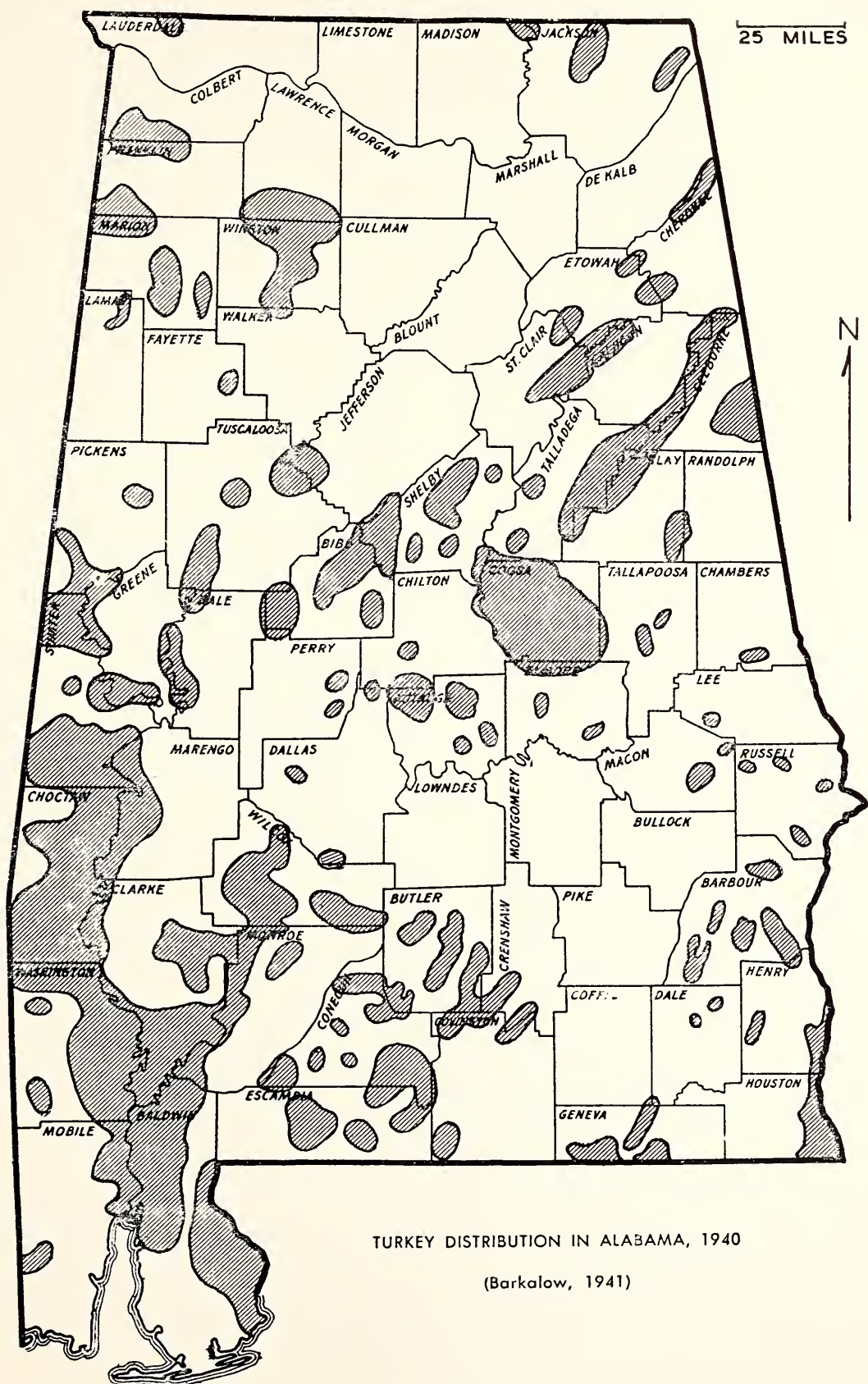


Figure 16

BALDWIN COUNTY

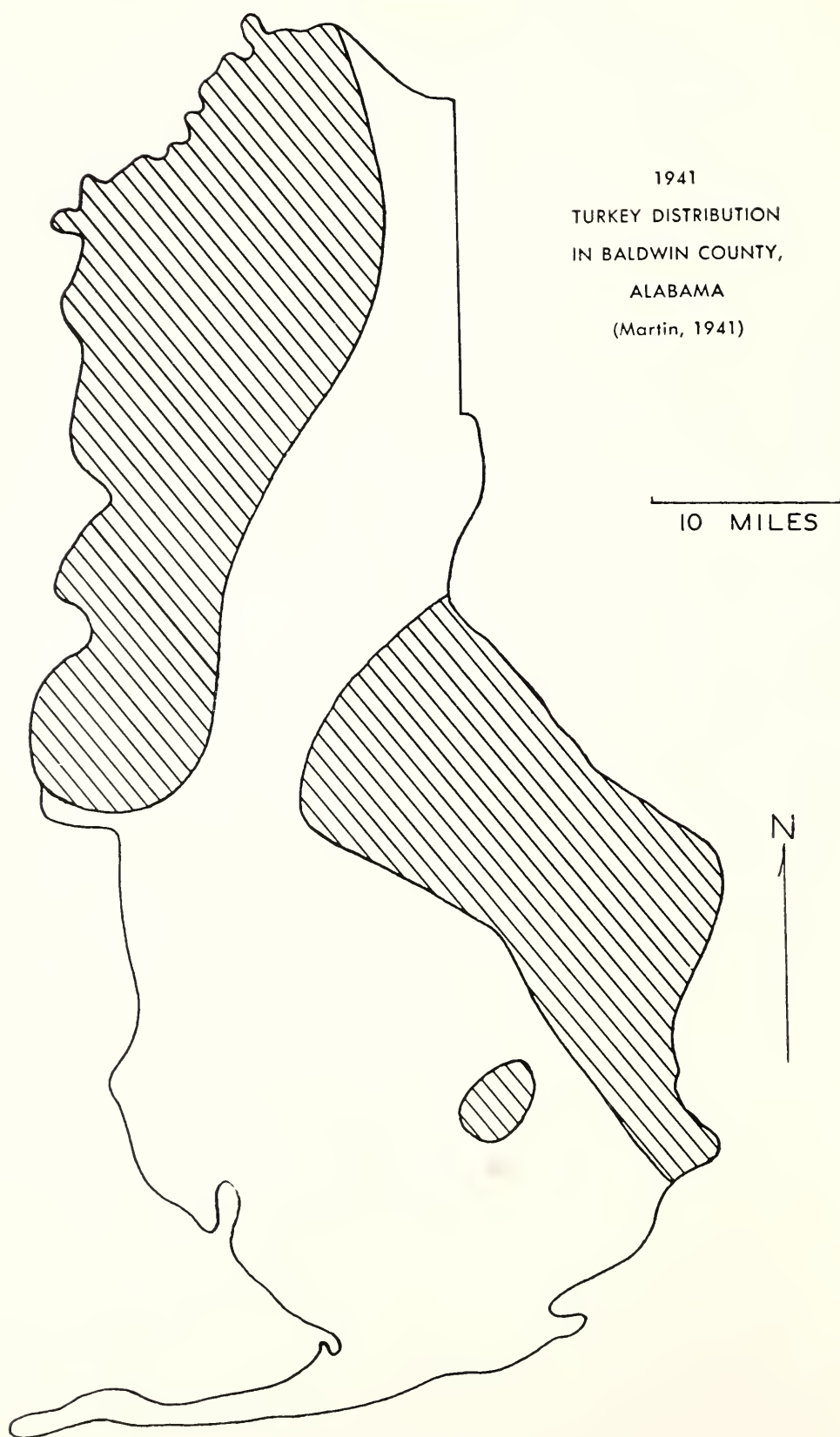


Figure 17

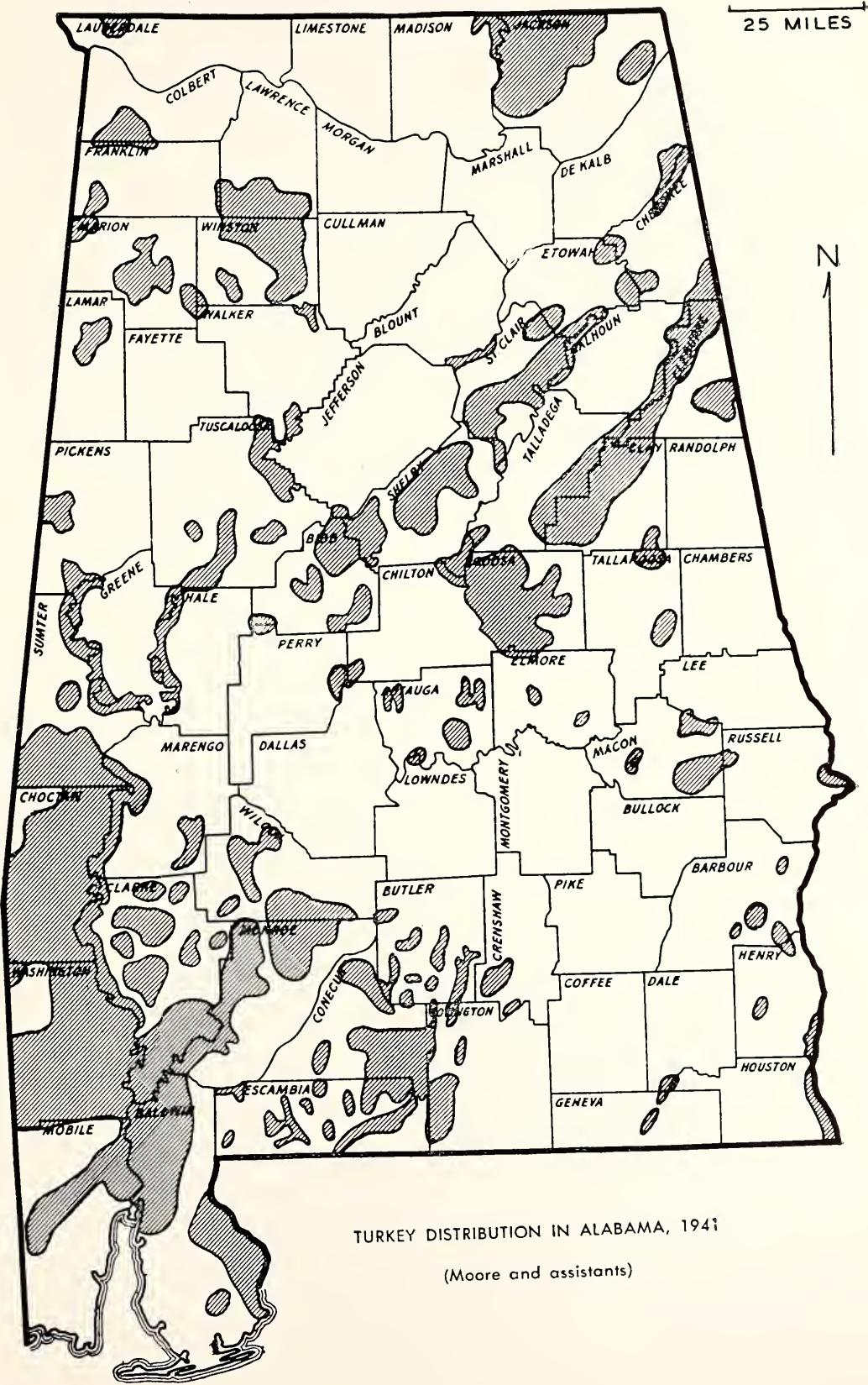


Figure 18



Figure 19

Wild turkeys are so conspicuous that many persons know the flock locations and the number of birds in each. Picture by—R. J. Wheeler, Jr.

The accuracy of the determination of distribution by different methods cannot be compared because one was employed to secure 1940 distributions and the other supplied 1941 distribution information. Of the two, that of Mosby and Handley is probably the better. A comparison of Figs. 16 and 18 (also Figs. 15 and 17) shows a close correlation between the ranges obtained by the two methods.*

In 1940, there was an estimated 11,600 birds in Alabama; in 1941, Moore (1942) reported approximately 13,500. The increase in the turkey population reported by the game warden on the Warden Game Trend Questionnaire, 1940-41 (Fig. 20), seems to be confirmed by these two estimates.

During the summer questionnaire survey, it was discovered that numerous domestic turkeys were being liberated in some of the best turkey ranges of the State and that a serious dilution of the wild stock was occurring. This condition is viewed with considerable concern and recommendations were made to the Director to prohibit this practice.

*See Appendix pp. 127-8 for the county turkey population estimates, using the two techniques.

SUMMARY OF DISTRIBUTION AND POPULATION ESTIMATES

Turkey distribution maps drawn by the game wardens and those plotted from data obtained during the Personally Administered Questionnaire survey were in close agreement. The method of Mosby and Handley probably provided more reliable population data than our questionnaire method, but the ranges obtained from the two techniques seemed to be of equal accuracy.

II. TRENDS

Trends in the turkey population were obtained from data gathered during the Personally Administered Questionnaire survey and from Warden Game Trend Questionnaires. Two other techniques, which gave promise of being useful in determining wild turkey trends, were tried, but neither of them was investigated sufficiently to do more than speculate as to its merit. These techniques are based on information secured from turkey nest and brood reports and from weight records of spring hunting kill.

WARDEN AND PERSONALLY ADMINISTERED QUESTIONNAIRES

Turkey population trends were obtained in the same manner as were those for quail. Figure 20, obtained from the war-

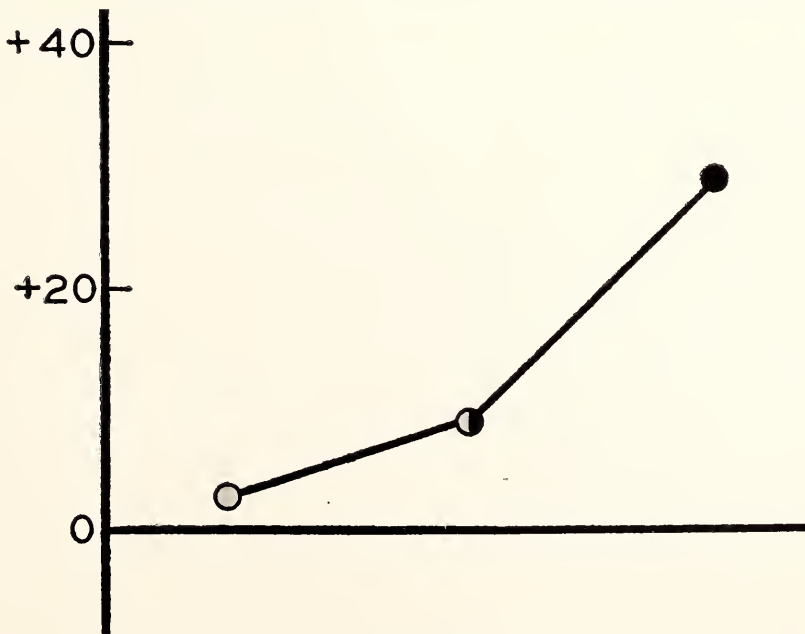


Figure 20
Warden opinion of wild turkey population trends.

den questionnaires, indicates a gradual increase in the number of turkeys during the three year period. Population estimates and the following observations by Pearson seem to confirm the warden reports.

Pearson (1940:68) stated that "In August 1940 young turkeys were reported as being more abundant than during the previous season. A high percentage of very small poults in August indicated that only a small number of the early nests were successful during the spring months." Again, Pearson (1941 :77) stated that "During the spring and summer of 1941 the natural propagation of wild turkeys was found to be more successful than during the preceding years. Apparently the spring drouth which was rather common throughout the southeast afforded the turkeys an opportunity to rear their young successfully without danger from the losses which are customarily sustained from high waters which overflow onto much of the nesting range" (Fig. 21).

The difference between the personally administered return of -2 and the +3 increase reported by the wardens is not



Figure 21

Spring floods destroy many turkey nests in the Alabama and Tombigbee River Bottoms of Clarke County. The water mark on the oak is approximately 12' high. Picture by—George C. Moore.

considered significant because of the incomplete coverage of the turkey range by the Personally Administered Questionnaire survey.

TURKEY NEST AND BROOD REPORTS

A record was kept of all turkey nests and broods seen by the wardens during the spring and summer of 1940. It was hoped that a sufficient number of reports could be secured to obtain an index of the nesting season success. Table V contains the information gathered by the wardens.

The earliest nest with eggs was found on February 15 and the earliest brood of poults was seen on April 10. Such a small number of records was available that only tentative conclusions could be drawn.

TABLE V

Number of nests with eggs.....	20
Average number of eggs per nest.....	12.45
Minimum number of eggs per nest.....	3
Maximum number of eggs per nest.....	16
Number nests known destroyed*.....	4
Nests known to have hatched successfully**.....	9
Number of broods of poults.....	16
Average number of poults per brood.....	10.00
Minimum number of poults in brood.....	4
Maximum number of poults in brood.....	14

The following quotation is from the writer's quarterly report of July 15, 1940: "From verbal reports and the 10.00 average on 16 written reports of poults, a tentative conclusion must be drawn that the early spring hatch of turkeys has been very good." The increase in the turkey population reported in the Warden Game Trend Questionnaire at the end of the 1940-41 hunting season helps to confirm this conclusion. It is believed that the number of poults seen and the number of eggs per nest will give a definite index of nesting success if such averages are derived from a sufficient number of records; possibly as few as 100. It would perhaps be better to base an index upon the per cent of eggs hatching rather than the per

*1 by hog, 1 by chicken snake, 1 by skunk (?), 1 by bobcat (?).

**The success of 7 nests was unknown.

cent of successful nests, because of the differences in the numbers of eggs between the first and second nesting attempts. The average brood size is the more reliable of the two.

WEIGHT RECORDS OF SPRING HUNTING KILL

Another possible method for evaluating the population of wild turkeys is the use of weight records of gobblers killed during the spring season (March 20-April 15). Turkey hens are protected in Alabama.

Prior to the 1946 "Gobbling Season" each warden was sent forms for reporting the actual and estimated weights of turkeys killed in his district. No attempt was made to secure records on all birds taken as only a small sample of the total kill was desired. Of the 243 birds reported, 158 were actually weighed and the weights of 85 were estimated. These latter records were discarded. Both actual and estimated weights were requested in order to eliminate the possibility of estimated weights being reported as actual ones. Figure 22 shows the areas open to hunting during the spring season and also the total number of records, both actual and estimated weights, obtained from each county.

As pointed out by Wheeler (1948), Mosby and Handley (*op. cit.*), and A. S. Leopold (1944), the weight of a turkey varies from season to season and from year to year. The average weights of 1-year old birds, 2-year olds, and those of 3 years and older seem to be sufficiently far apart to provide an index to the composition of the population. There are, however, a number of factors besides age that cause the average weights of turkeys to vary; the amount of food in the turkey's crop, the availability of mast, the success of the early nesting season, and the severity of the winter are some. If sufficient notes were kept on the success of the nesting seasons and mast crops, it might be possible, by shifts in the peaks and in changes of composition of the weight classes reflected in the histogram, to determine population trends. Admittedly, Pestrices' (1942) method of aging turkeys from plumage characters is more reliable than using weights, but it is doubted if all game wardens would employ his method correctly. Weights are easy to obtain and both the hunter and the warden are interested in them.

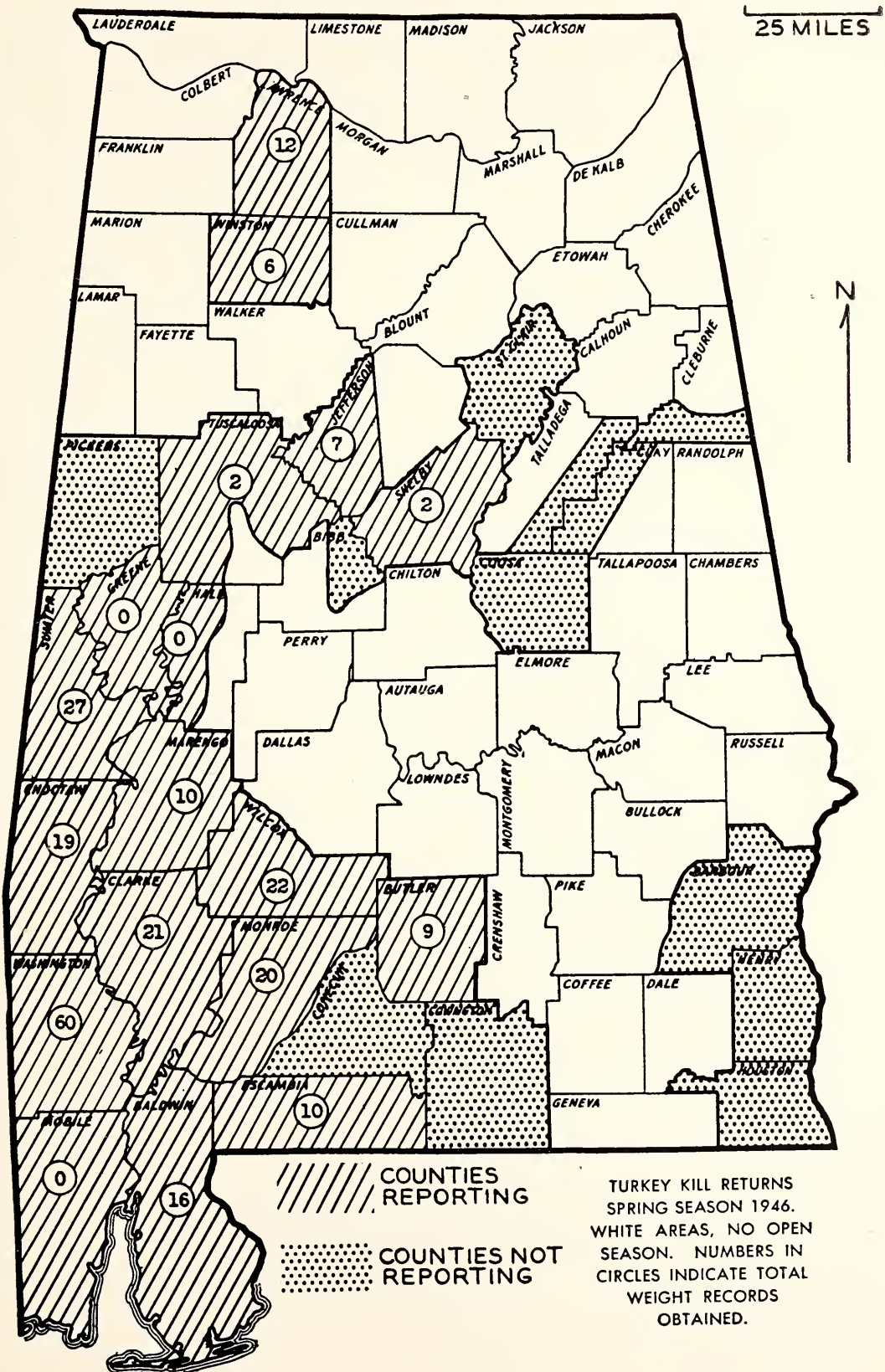


Figure 22

Seven South Alabama gobbler poult trapped by Wheeler (*ibid.*) in March averaged 10 pounds 12 ounces. The smallest weighed 10 pounds 4 ounces and the largest weighed 11 pounds 15 ounces. Poults trapped at other seasons consistently weighed less than 12 pounds. It hereby appears that all gobblers reported in the 12 pound and lower categories should be considered less than one year old (Fig. 23 and Table VI). In a few instances, an adult gobbler was found that weighed less than 12 pounds, but such individuals were the rare exceptions. The average reported weight of 15 South Alabama gobblers less than 1 year old, was 10 pounds 11 ounces. This figure seems to agree with Wheeler's March average of 10 pounds 12 ounces.

All birds in the 13-pound and heavier divisions are considered to be adults. The average weight of 122 South Alabama gobblers in this category averaged 16 pounds 14 ounces. Three known adults trapped by Wheeler in March and April averaged 16 pounds 15 ounces.

Data obtained in Virginia by Mosby and Handley indicate that birds in the 13- to 15-pound category are between 1 and 2 years old, but there is some evidence* that in Alabama, gobblers approaching 2 years will fall into the 16-pound classification. Gobblers reported in the 13-16 pound division are considered to be between 1 and 2 years old. The 42 individuals in this increment averaged 14 pounds 14 ounces. This separation is not as distinct as the poult or the "2 year plus" groups.

A. S. Leopold (*op cit.*) found the weights from 8 "pure" *silvestris* between 8 and 15 months of age to average 10 pounds 8 ounces while the average of 17 hybrids in the same age group was 13 pounds 10 ounces. Since hybrid birds are heavier, it is necessary to make a separate evaluation of kills from those areas occupied by impure stocks. Hybrids are scarce in most of our better turkey ranges; however, in parts of North Alabama the wild strain is badly diluted with domestic blood. This is re-

*A wild turkey (#29) banded by Wheeler as a poult weighed 15# 12 oz. when approximately 21 months old. Another (22#) weighed 15# 12 oz. at approximately 24 months of age.

flected in the 18 pound 6 ounce average of 20 adult North Alabama birds reported by the wardens.

With the small amount of data available, it is impractical to evaluate the potentialities of this method. It appears to warrant additional investigation.

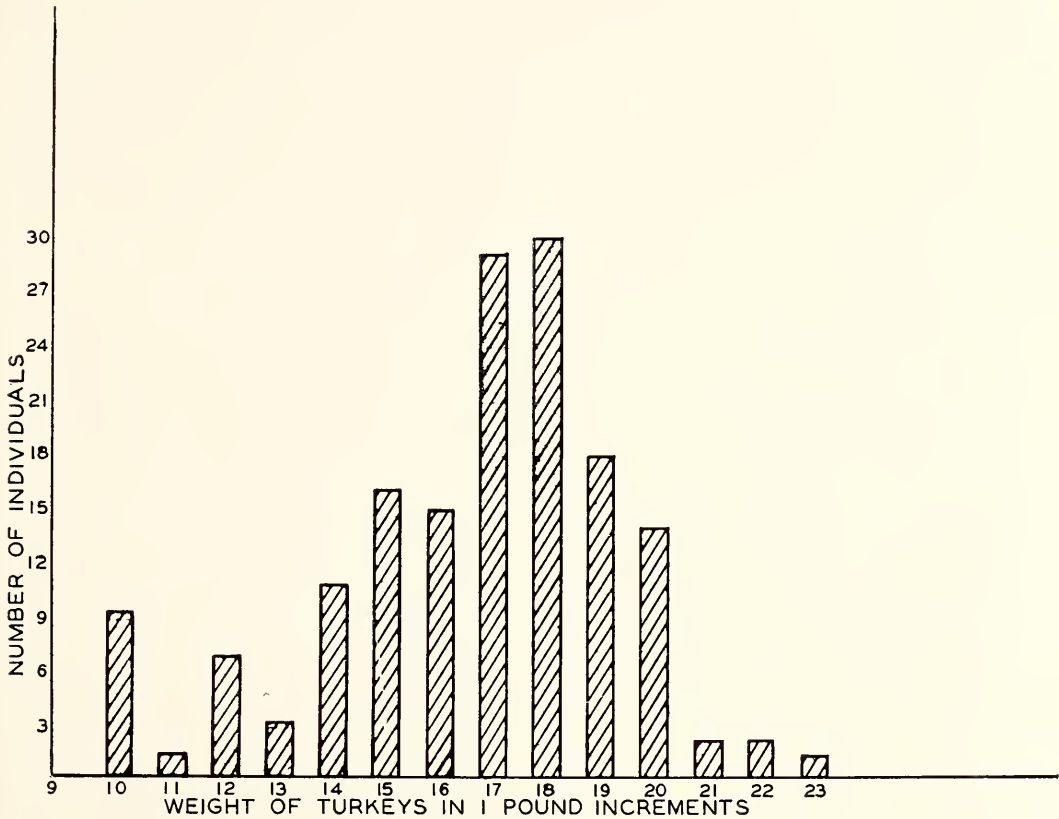


Figure 23

TABLE VI

TURKEY WEIGHT CLASSES

Weight (pounds)	Number Turkeys	Weight (pounds)	Number Turkeys
10	9	17	29
11	1	18	30
12	6	19	18
13	4	20	14
14	11	21	2
15	16	22	2
16	15	23	1

THE WHITE-TAILED DEER INVENTORY

I. DISTRIBUTION AND POPULATION ESTIMATES

PROCEDURE

Deer distribution was determined in the same manner as was that of the wild turkey (p. 43). Figures 24 and 25 show the 1940 deer distribution obtained from the Personally Administered Questionnaires, Part 2. The 1941 distribution determined by Moore and his assistants (Figs. 26 and 27) was plotted from data obtained during the field survey of the larger game species.

Populations of deer were harder to determine than were those for turkeys since deer herds are, at best, loosely constructed and the species is less gregarious by nature. Estimates were based on information supplied by farmers, wardens, and lumber company owners. In each particular area we endeavored to get, as an index, the approximate number of acres inhabited by a known number of individuals. This index was then expanded to include the inhabited range in that part of the State. The method is not as arbitrary as it might seem to one unfamiliar with the conditions in the southeast. The majority of the deer are found on private tracts. Almost all landowners make a considerable effort to protect this species and to follow their movements. It was only from such individuals that we accepted data to use as an index.

It was also possible to secure reasonably accurate population figures from dog and drive hunts. In areas of low concentration, data were frequently obtained on the movements of individual animals, but in the deep swamps of Clarke, Washington, and Mobile Counties an accurate estimate by any practical method is almost impossible (Fig. 28).

One method that has considerable merit is to survey the high land and small islands in the Alabama and Tombigbee River bottoms when they are flooded (Fig. 21) and the deer and turkeys are driven from the low areas of dense vegetation. Some of

BALDWIN COUNTY

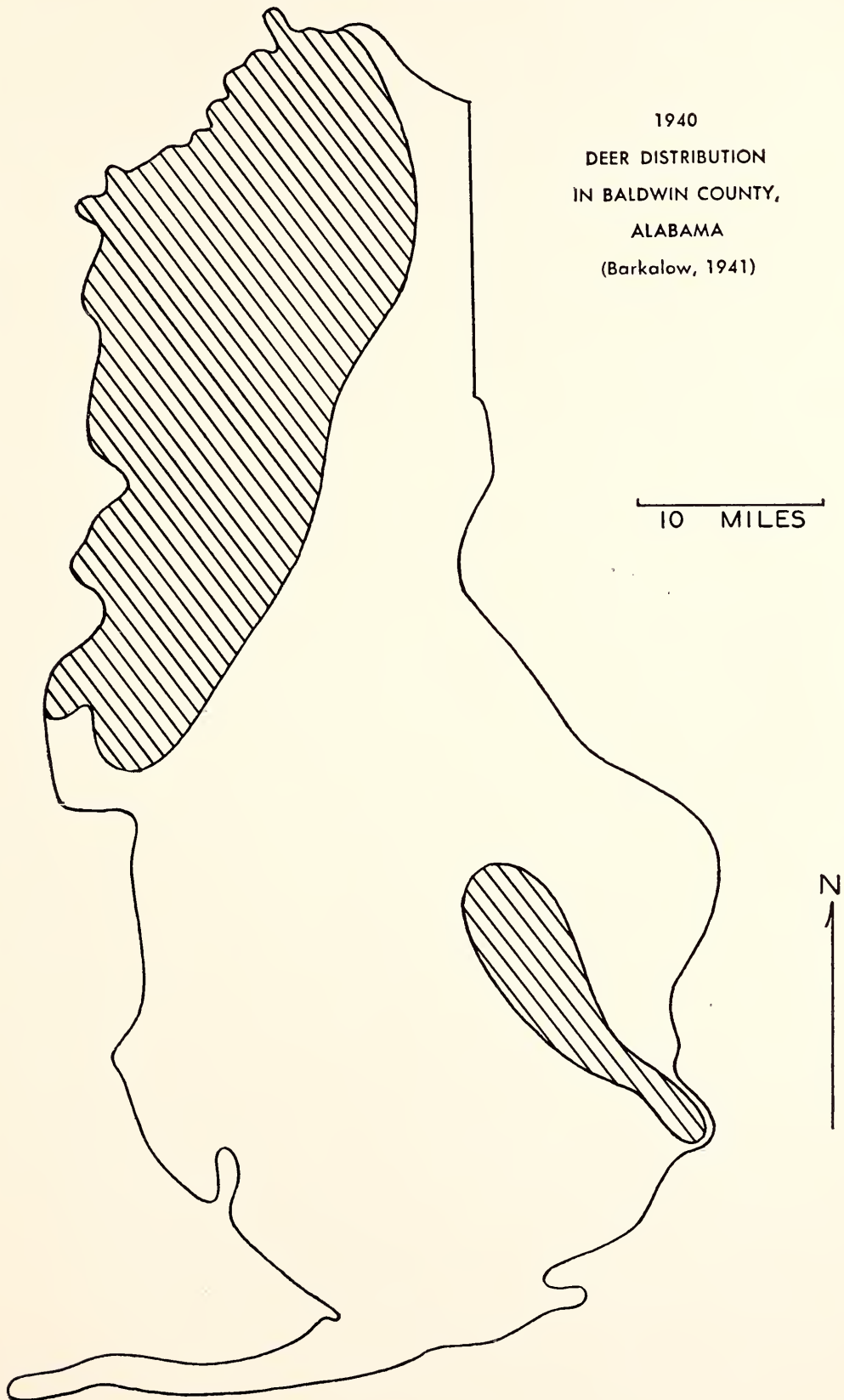


Figure 24

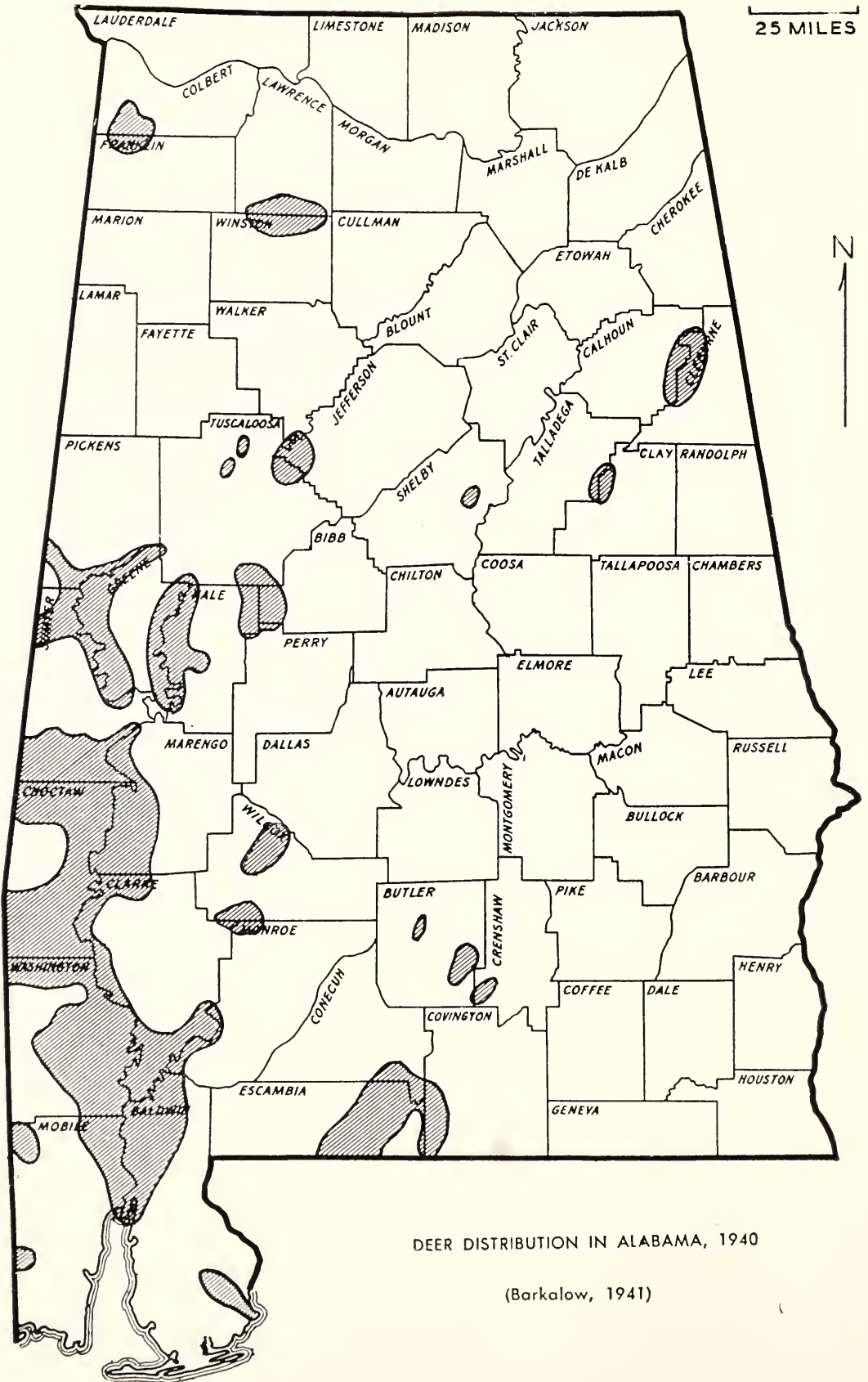


Figure 25

BALDWIN COUNTY

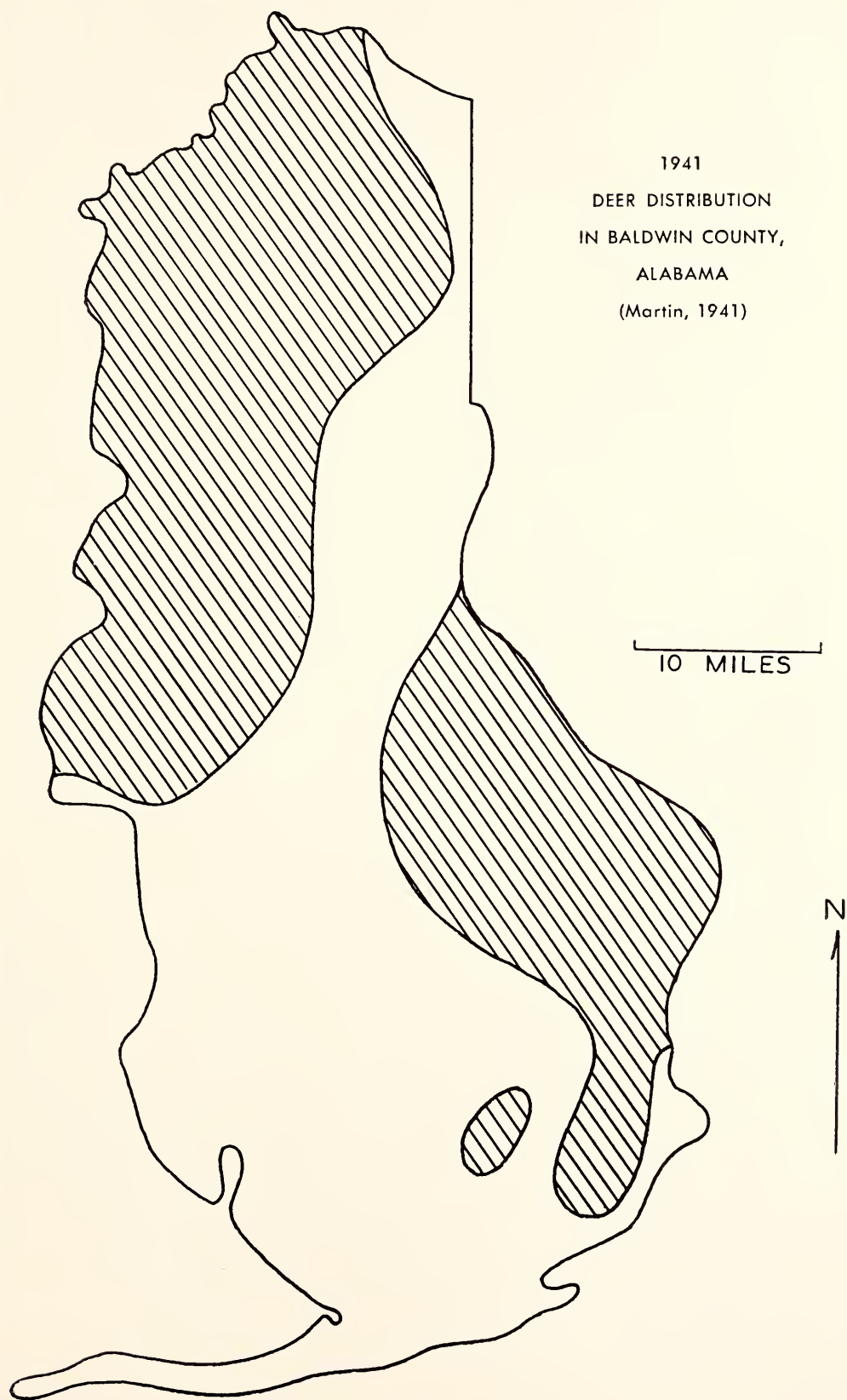
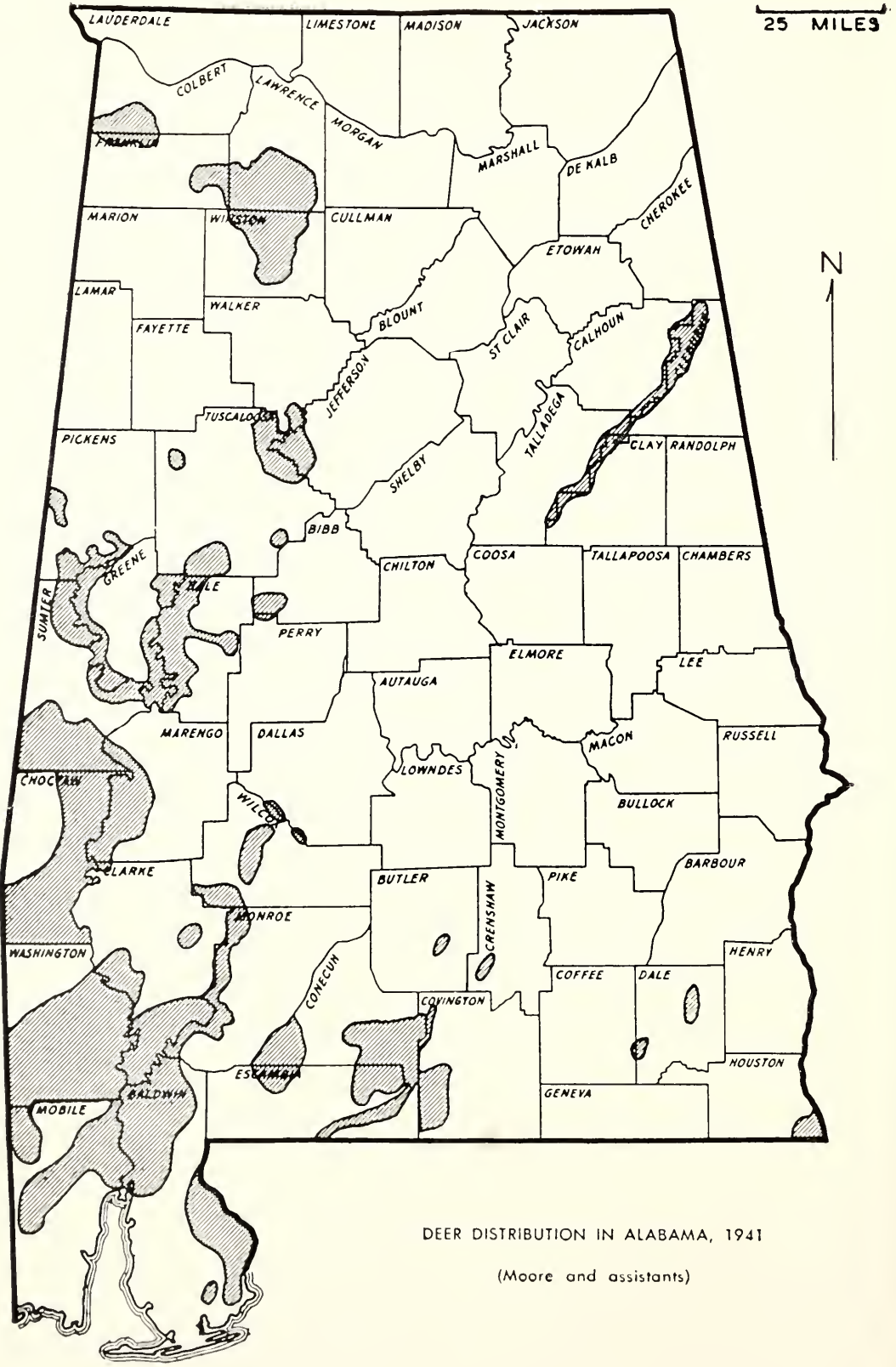


Figure 26



DEER DISTRIBUTION IN ALABAMA, 1941
(Moore and assistants)

Figure 27

the wardens counted the deer and turkys on the high land during the floods and obtained unusually accurate results.

Erratic results were obtained from road counts and no confidence was placed in the data secured by this method.

RESULTS

The population estimate made from Personally Administered Questionnaire* data was 16,000 deer as of the spring of 1940. Moore made a more conservative estimate of 14,000 individuals as of the fall of that year. Since his estimates were based on more intensive field investigations, it is believed that the figure of 16,000 animals is liberal. The 1940-41 deer population was greater than that of the previous season.

SUMMARY OF RANGE DETERMINATION AND POPULATION ESTIMATES

The method used in estimating the Alabama deer population is only an approximation. All commonly used census methods gave unreliable results in the river bottoms since there were few roads on which to make strip counts, many areas are too thick to work, some parts are too boggy to drive, and the Spanish moss (*Tillandsia usneoides* Linn.) precludes accurate aerial surveys. Drives made during deer hunts will give fairly good estimates of the upland areas, but there are enough animals in the swamps to seriously influence population results based on upland figures that are extended to include the entire range.

Reasonably accurate distribution maps for both turkey and deer may be obtained from Personally Administered Questionnaire survey data. These questionnaires reduce the amount of travel required in making an intensive follow-up survey of the larger game species.

*Appendix p. 128.



Figure 28

The Alabama River near Stockton, Baldwin County, Alabama.

II. TRENDS

The trend in the deer population indicated by Warden Game Trend Questionnaires was one of steady increase during the entire period. This is in agreement with field observations. The increase is attributable to two factors, (1) increased protection given the species by private landowners, and (2) reduced hunting pressure during the war years. The Personally Administered Questionnaire result of +19 agrees with that of +26 from the warden survey.

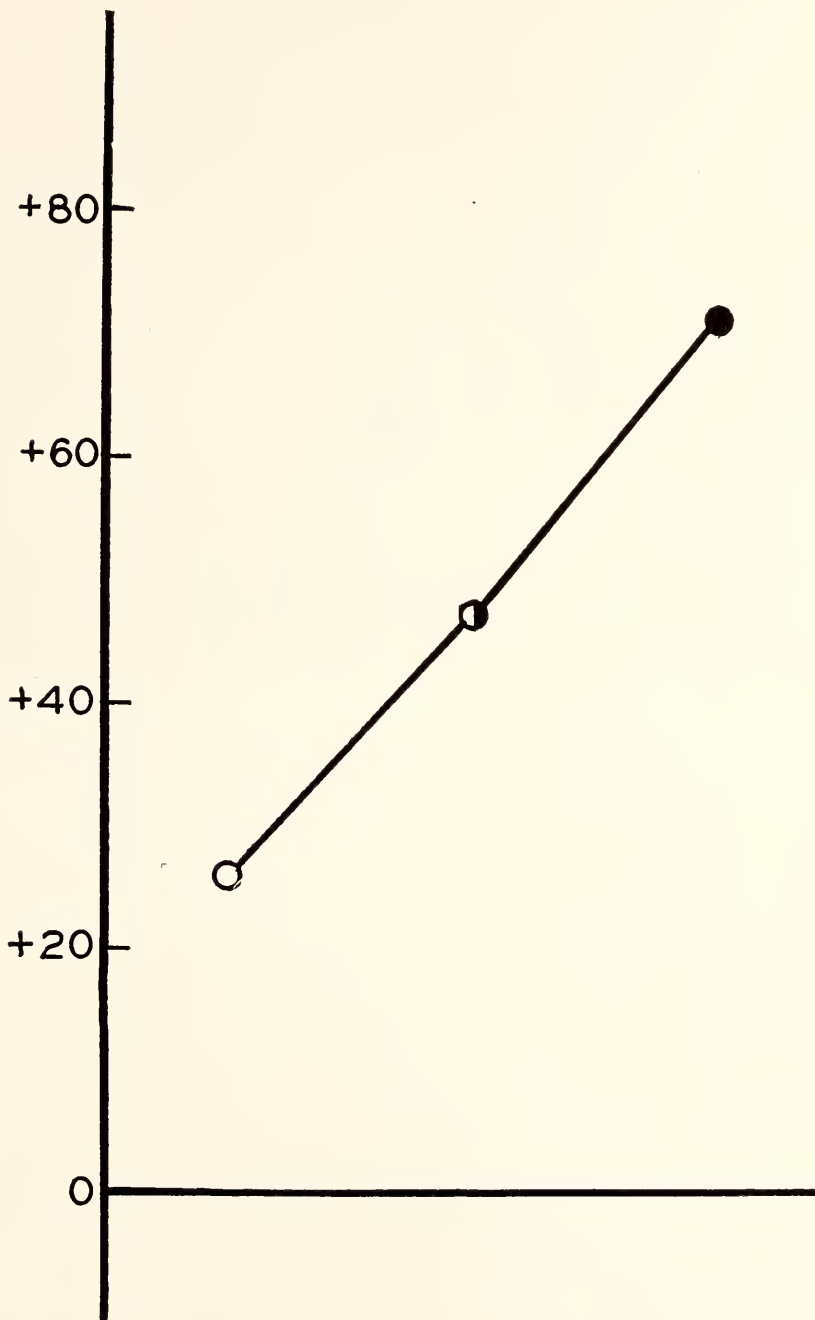


Figure 29

Warden opinion of white-tailed deer population trends.

THE WATERFOWL INVENTORY

I. CENSUS METHOD

A waterfowl census has been made in cooperation with the U. S. Fish and Wildlife Service's inventory in Alabama each year since 1935. The one made in 1941 (from January 15-17) is believed to have been more nearly accurate than any made previously. More observers were available and a better census method was developed for use in the Mobile Bay area. Mobile Bay and its marshes contained at that time an estimated 60 per cent of the total waterfowl population wintering in Alabama.

PROCEDURE

The upper portions of Mobile Bay and the tree swamp areas were covered as usual by wardens on foot and in boats. The coastal regions and the open deltas, where the majority of waterfowl were concentrated, were covered in a liaison type airplane on the 15th and 17th of January. Inclement weather prevented a complete coverage of the Delta and Gulf coast on January 15. On January 17, all of the bays in the Mobile delta were covered carefully. Visibility was excellent and it is believed that at least 75 per cent of the waterfowl present were seen.

Each bay was observed at an altitude sufficiently high to prevent frightening the birds. A sketch was made of the bay and each raft of ducks in it. The largest raft was assigned a value of 100 per cent and every other raft was given a percentage rating based on the size and concentration of its ducks relative to the largest one. In rafts containing less than one hundred birds, the individuals were counted and actual figures recorded. The largest raft was then photographed (using panchromatic film) and complete data recorded. Identifications of the various species were made at altitudes of from twenty-five to one hundred feet and recorded on the data sheet for that particular bay.

Special attention was given to the possibility that waterfowl near the shore might seek to escape by hiding in the marsh



Figure 30

Emergent vegetation is more abundant in the upper bays of the Mobile delta, but the number of waterfowl in such areas is limited.

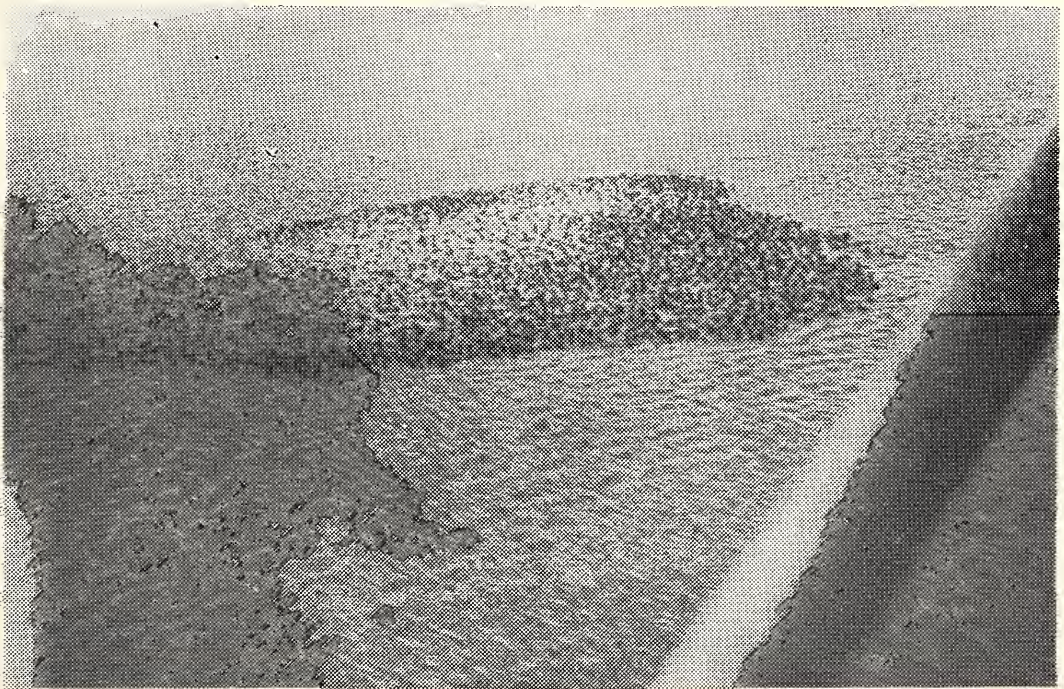


Figure 31

Coots in John's Bend, January 15, 1941. There are 2,505 in this picture. "Tight" rafts are characteristic of the species in this area.

vegetation (Fig. 30). The number of birds missed in this manner was probably small since only an occasional isolated bird would make the reeds. Invariably, ducks in the larger rafts would take the air or flutter a few feet and "sit down" again. Mallards and black ducks were the most likely to break for the vegetation in order to escape. Most of them could be flushed by buzzing the marsh. Photographs taken of the larger rafts provide a factual basis for making accurate population estimates; it is possible to count almost every duck even in the largest ones (Figs. 31, 32, 33, and 34).

The ducks on the photographic print were counted with the aid of a low power binocular microscope and a mechanical counting device. As each bird's image was counted on the print, a hole was punched in it to prevent recounting. When the total number of waterfowl in the largest raft was determined, each of the smaller raft populations in that bay was computed and the total population in the open delta calculated.

Airplane waterfowl inventories have been used for a number of years and the literature contains numerous references to the use and possibilities of an aerial camera as an aid in



Figure 32

Canvasbacks, mallards, pintails, lesser scaups, and baldpates in Chacalochee Bay. Approximately 50 per cent of the raft is included in the above print (2,521 individuals were counted in it).

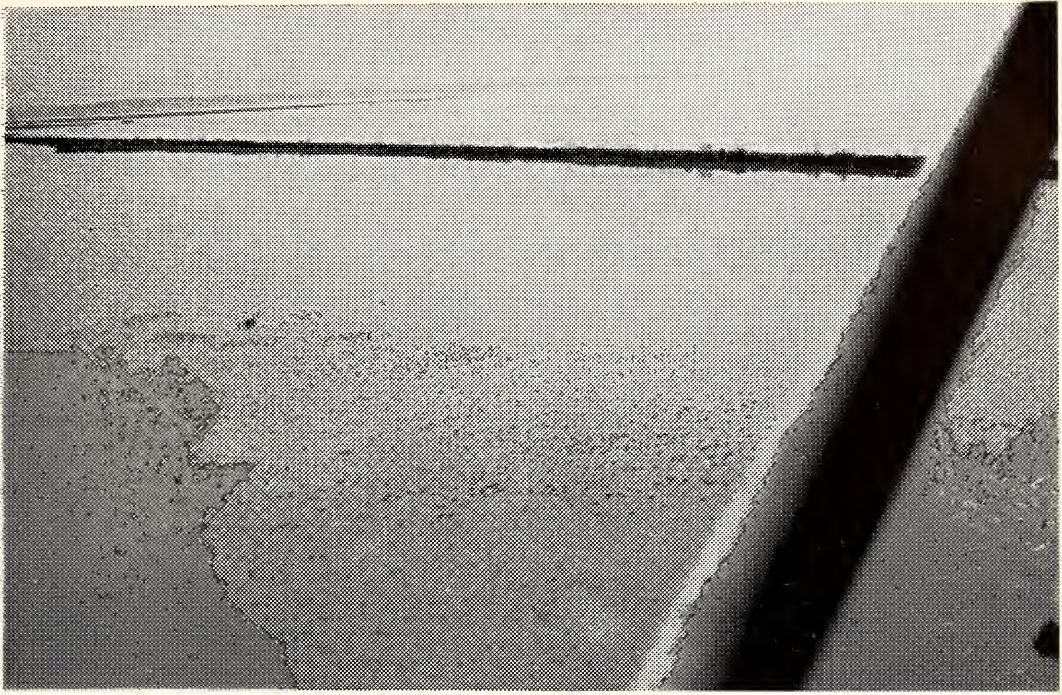


Figure 33

A raft of 1,548 pintails photographed in Chacaloochee Bay.



Figure 34

A raft of 2,000 baldpates (1,036 shown on this print) in Chuckfey Bay on January 17, 1941.

making such censuses. Hawkins and Bellrose (1946) and Leedy (1948) are some of the later authors to suggest its use. Spinner (1946) published a detailed account of such an inventory. His method is somewhat different from that devised for use in the Mobile delta region as it depends upon the comparison of photographs containing a known number of birds with a raft of unknown size. While his method can be used over a wider range of conditions than the one above, its accuracy is also believed to be less when used under conditions similar to those in the lower bays of the Mobile delta. His method has not been checked against the one discussed here.

A small 120 (size $2\frac{1}{4}$ " x $3\frac{1}{4}$ ") Zeiss Ikon Cocarette folding camera with an f 4.5 lens and a compur shutter was used in this survey. Even with such crude equipment, photographs of sufficient clarity were taken to enable each duck in a raft to be counted. Since the bulk of the waterfowl in Alabama winter in the Mobile delta, and the majority of them feed and loaf in the open bays, a highly accurate census of the waterfowl wintering there can be made. Comparative results for subsequent or previous years are not available because flying of this type was not allowed during the war and the area was not covered by plane in 1940.

RESULTS OF THE 1941 INVENTORY

Because of inclement weather, the January 15 census in Baldwin County was not considered to be as nearly accurate as the one made on January 17.

The data obtained during the course of the 1941 inventory and from field work in the Mobile Delta indicated that:

1. There has been a decrease in the number of waterfowl wintering here. This conclusion is based both on the independent findings of the Inventory of Wildlife Resources project and those of such experienced waterfowl observers as Mr. Fred Smith, Game Warden, Mr. Wiley Hamilton, and Mr. Jamie Jamison. All of the men mentioned above have worked in these marshes for many years and the latter two have made their living acting as guides and renting boats to hunters and fishermen for years.

2. The decrease in waterfowl was not limited to the Mobile Bay region; there was a decrease in the total number of wintering birds throughout the State. This is indicated by the returns from the Game Warden Game Trend Questionnaire (Table XIII and also Fig. 36) which, in comparing the 1940-41 season with the 1939-40 season, indicated a minus 16 difference between those counties reporting an "Increase" and those reporting a "Decrease."
3. The method developed by the wildlife inventory project will give a very accurate census of wintering waterfowl in the Mobile delta because:
 - a. The rafts can be easily seen and counted from a low flying plane provided the weather is *clear* and the *water is relatively calm*.
 - b. Ducks within a raft can be counted accurately on photographs made on clear, calm days. This method was tested by photographing a known number of wooden decoys.

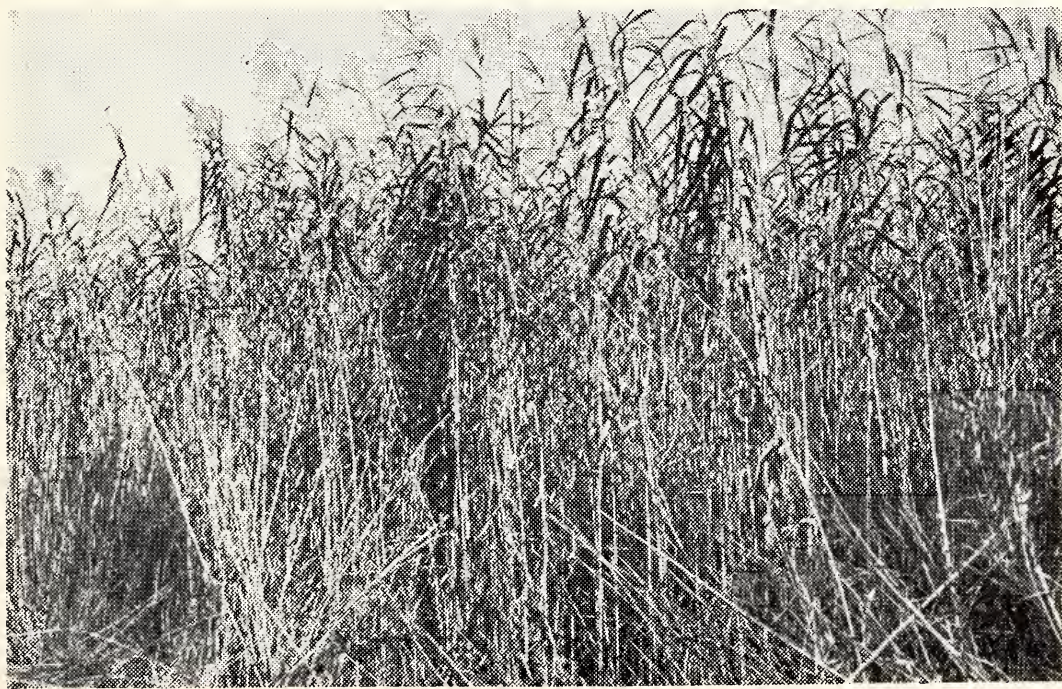


Figure 35

The "Cane" (*Phragmites communis*) growing along the edges of the lower bays is so dense that even wounded ducks will rarely seek escape in it. Picture by—G. C. Moore.

- c. Since the lower bays are deltaic "bends" the marsh vegetation grows to the water's edge and stops (Fig. 35). There is practically no emergent vegetation in which ducks can hide. The only way in which they can escape detection in the vegetation is by leaving the water and walking or flying into it. A duck will not take to the marsh to escape a hunter, hawk, boat, or plane unless it is crippled. It is seriously doubted if a large number of birds are missed as a result of their hiding in the marsh vegetation.
4. Experienced game wardens were able to make very dependable estimates of the duck population in the Mobile delta. These were frequently checked by later counting the ducks in a raft. There seemed to be a tendency for the wardens to overestimate slightly the number of individuals in very large rafts, but their accuracy was surprising with the smaller rafts.
5. Most experienced duck hunters greatly overestimate the number of birds in large rafts and the total population in the Mobile delta.

CONCLUSIONS

The use of the waterfowl census method outlined above in the lower Mobile Delta and in the Tennessee Valley would provide a very accurate index for the annual waterfowl population wintering in Alabama because approximately 80 per cent of these birds are found in these two areas. Ground observers could be used to census areas not adaptable to coverage from the air.

This method seems to be one of the most nearly accurate waterfowl census methods so far developed for open water areas and moderate waterfowl populations. Its use is limited, however, to open bays and large bodies of water without emergent vegetation.

The greatest error that might be made in air observations in the Tennessee Valley and Mobile Bay would result from covering too much territory hastily and thereby overlooking the many small rafts.

Population estimates by experienced game wardens are quite reliable, but most estimates by duck hunters are not.

II. TRENDS

The waterfowl population trend obtained from the Warden Game Trend Questionnaires shows a consistent decrease. In an effort to evaluate these reports, waterfowl population figures representing the results of the annual waterfowl inventories in January of each year were obtained from the U. S. Fish and Wildlife Service. These waterfowl figures for Alabama are as follows:

YEAR	SEASON	POPULATION
1939	1938-39	81,177
1940	1939-40	106,925
1941	1940-41	176,349
1942	1941-42	96,328

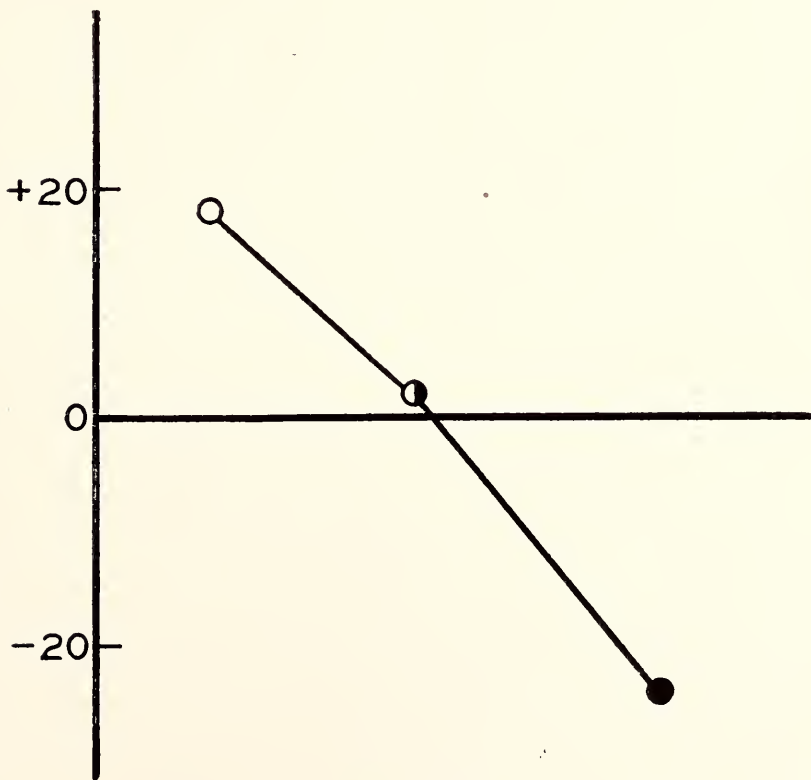


Figure 36

Warden opinion of waterfowl population trends.

It would appear that the first point on the graph is correct because there was an increase in the 1939-40 wintering population over the one in 1938-39. In 1941 (point two on the graph) there seems to be a wide discrepancy; we obtained a report of -16 and the Fish and Wildlife Service figures indicated an in-

crease of approximately 70,000 birds. There was an actual decrease in the wintering population and the apparent increase shown by the above figures was the result of Alabama being more completely covered in 1941 than in 1940. The following quotation is from the author's report to the Alabama Department of Conservation shortly after the 1941 inventory was completed:

“All members of the research staff took part in the Annual Waterfowl Inventory during January, 1941. Alabama showed a slight increase in the total number of waterfowl reported due to a more complete coverage of the State. The increase was not due to an actual increase in the number of waterfowl wintering here.”

It is obvious that the figures from the annual waterfowl inventories must be used with caution since the technique used gives unreliable results at times. The third point on the chart is again in agreement with the Fish and Wildlife Service figures because there was a decrease in the 1941-42 wintering population.

The warden report of +18 (p. 126) and the personally administered figure (p. 125) of +15 seems to be in agreement.

THE BEAVER INVENTORY

I. DISTRIBUTION AND POPULATION ESTIMATES

PREVIOUS SURVEYS

The first attempt to inventory the beaver (*Castor canadensis carolinensis* Rhoads) population in Alabama was made in 1929 by game wardens under the direction of I. T. Quinn. Beavers were found in 26 counties (Anon.: 1929), but the colony locations were not enumerated and it is impossible to compare these findings with later surveys. Although the population was larger in 1929 than it was in 1912 when Howell (1921) made a biological survey of Alabama, beavers were still very scarce. Quinn's wardens were able to locate only 41 dams in the entire State. These animals were not protected by a completely closed season until the fall of 1938; yet, in spite of heavy trapping, they were able to increase from a low of probably less than 100 at the turn of the century to a population of approximately 1000 individuals in the early 1930's. Excessive trapping in 1937-38 again almost caused their complete extermination. Arant's 1938 questionnaire survey (1939) indicated that at the end of 1937-38 season they were "Abundant" in only 1 county (Russell), "Common" in 5, "Scarce" in 27, and "Absent" in 34 (Fig. 37). A "Doubtful" rating was interpreted to mean that the species was practically extinct in the county. This assumption appears to have been correct. An inventory made 2 years later showed them to be present in 29 counties, and in only 13 of them could they be considered "Abundant" even though they had been given complete protection from hunting and trapping during this period. In the fall and winter of 1937-38, beavers were extirpated in almost all counties rated by Arant as "Scarce." In Chambers County, which was rated "Common," they were completely trapped out. It is doubtful if 500 beavers remained in Alabama after the season closed in February, 1938.

SURVEYS BY INVENTORY PERSONNEL

Our first state-wide beaver inventory, in February, 1940, consisted of sending a questionnaire blank and instruction sheet to each warden requesting information on the species in his

district. Returns from this survey indicated that there were 58 colonies or colony groups in 19 counties of the State (Fig. 38).

The second survey was incorporated with the Personally Administered Questionnaire work. Special efforts were made to visit all colonies reported by the wardens, and to determine if there were any additional ones in the State. From April to November, 1940, approximately 100 previously unreported colonies were found. The majority of these were discovered by the inventory personnel, although a number were found by the game wardens and the state trapper. Figure 39 shows the distribution of beavers* plotted from questionnaire data.

A third survey was made by Moore and his assistants. Using the data from the previous inventories as a basis, they checked all streams in the vicinity of known colonies. Beavers were located in two additional counties (Elmore and Covington). Covington County contained but a single colony of approximately three individuals, and Elmore had three small colonies. A number of new beaver groups (Fig. 40) were discovered, colonies that had not been in existence when the original surveys were made. A few colonies which had been missed by the questionnaire work were also located. The beaver population was reported to be in excess of 1000 animals in 1940 (Barkalow: 1940), and by November, 1941, Moore (1941) estimated it to have increased to approximately 3500 head. The estimation of a beaver population in a state is extremely difficult and no satisfactory technique has as yet been devised. Warren (1926) based his estimates on an index of 8 beavers per active house with some consideration made for the number of bank dens. Bradt (1938) found that active houses did not give reliable population data in Michigan. Estimates are even more difficult to make in the South because less than 20 per cent of the beavers live in stick houses. Our approximations of colony size were based largely on the number of fresh cuttings, the size of the impoundments, the number of bank dens, and active stick houses, when the latter were present. At the beginning of the survey, certain of the colonies were visited with the state trapper who had over 30 years experience trapping this species. "Beaver Sign" and other factors on which his population estimates were based were pointed out, and as the live trapping results became

*See Appendix pp. 129-33 for colony locations.

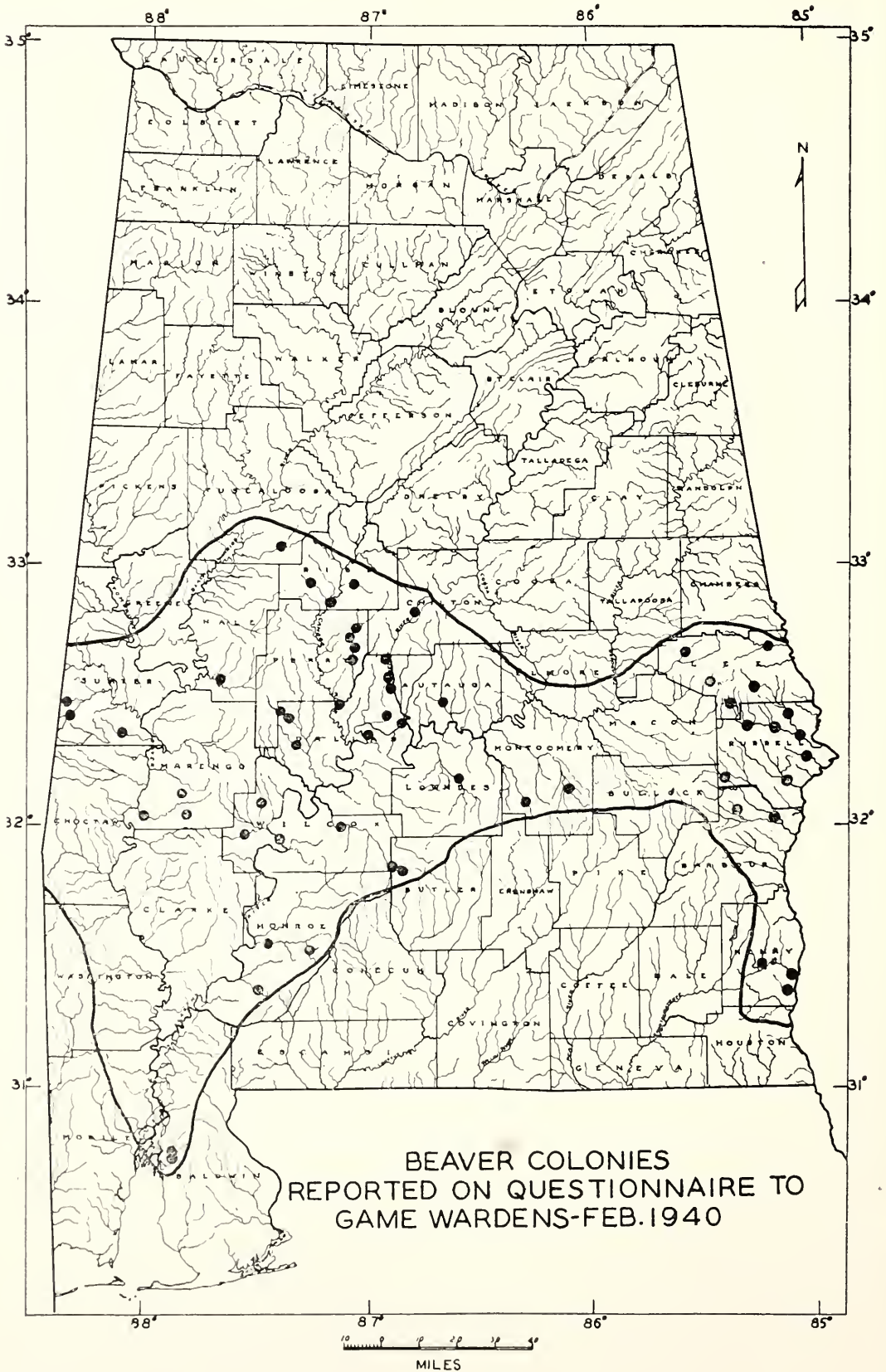


Figure 38

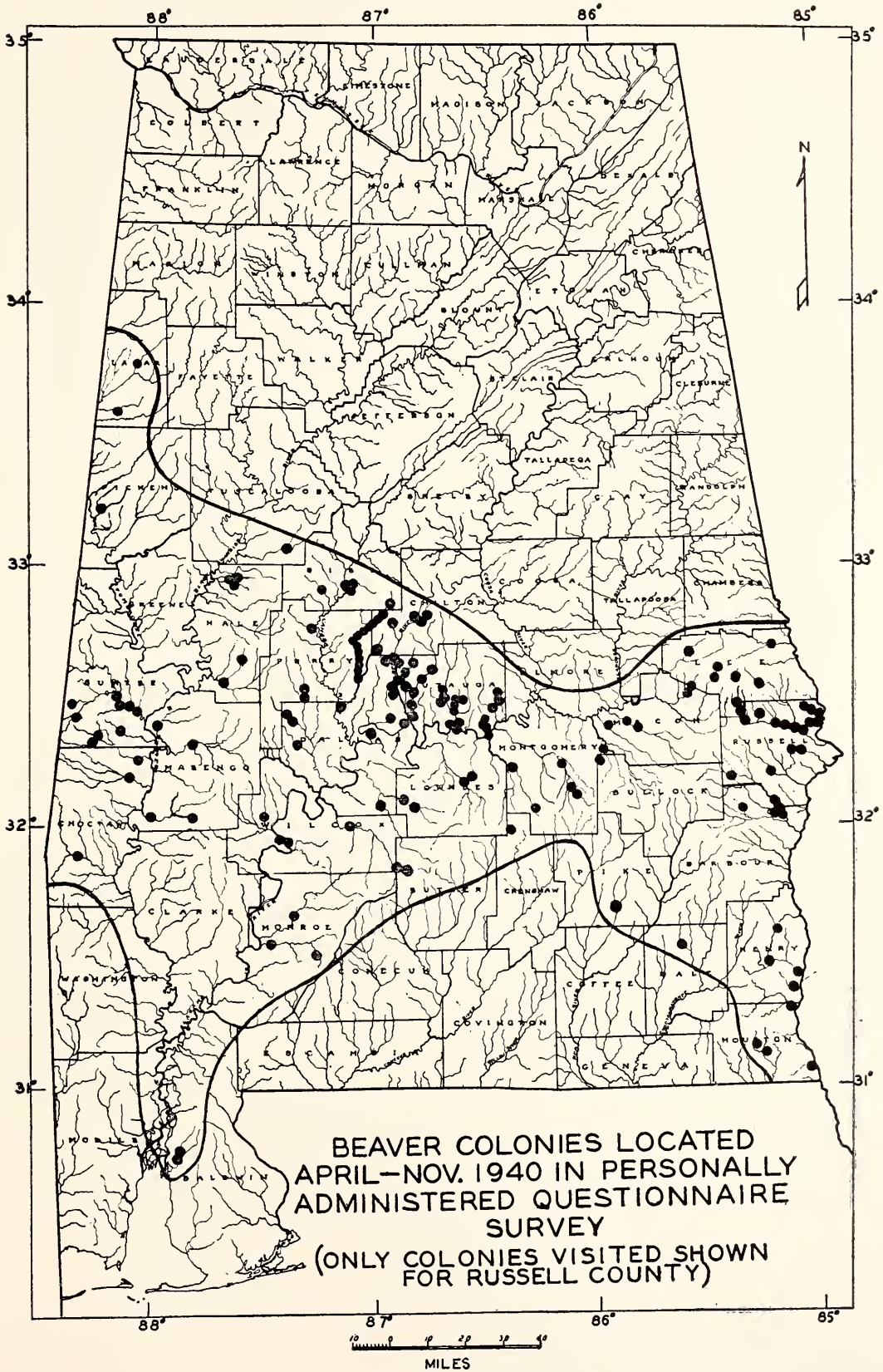


Figure 39



Figure 40

A new beaver colony in Russell County, Alabama. The house is 14' x 18' at the water line and the dam forming the 5-7 acre lake is 474' long. Picture by—G. C. Moore.

known it was apparent that he could estimate the size of a colony with a considerable degree of accuracy. After some experience, we learned to evaluate these "signs" with sufficient accuracy to make close estimations of colony populations. Trapping out nuisance beavers provided a basis for checking these estimates. Admittedly, the method is arbitrary, but it is the best available for obtaining beaver population figures in the South. No one factor can be assigned a definite mathematical value because there are too many variables. It is only by seeing all the evidence in the field and evaluating each factor in terms of the others that the number of animals in a colony can be estimated.

SUMMARY AND CONCLUSIONS

The game warden questionnaires provided the groundwork for later surveys, but they were not sufficiently complete to furnish accurate distributional data. The warden questionnaires saved considerable time by supplying information on occupied streams and stream systems (Fig. 38). The wardens made a

greater effort to furnish complete and valid information after they became acquainted with the purpose of the project.

The Personally Administered Questionnaire survey furnished reasonably accurate distributional data. Moore's procedure provides sufficient data for making accurate distribution maps and estimating beaver abundance.

II. TRENDS

Beaver trends were obtained from the Warden Game Trend Questionnaires and the Personally Administered Questionnaire, Part 2. In comparing the 1939-40 season with the 1938-39, the warden return of +15 is in complete agreement with the personal questionnaire result of +16.

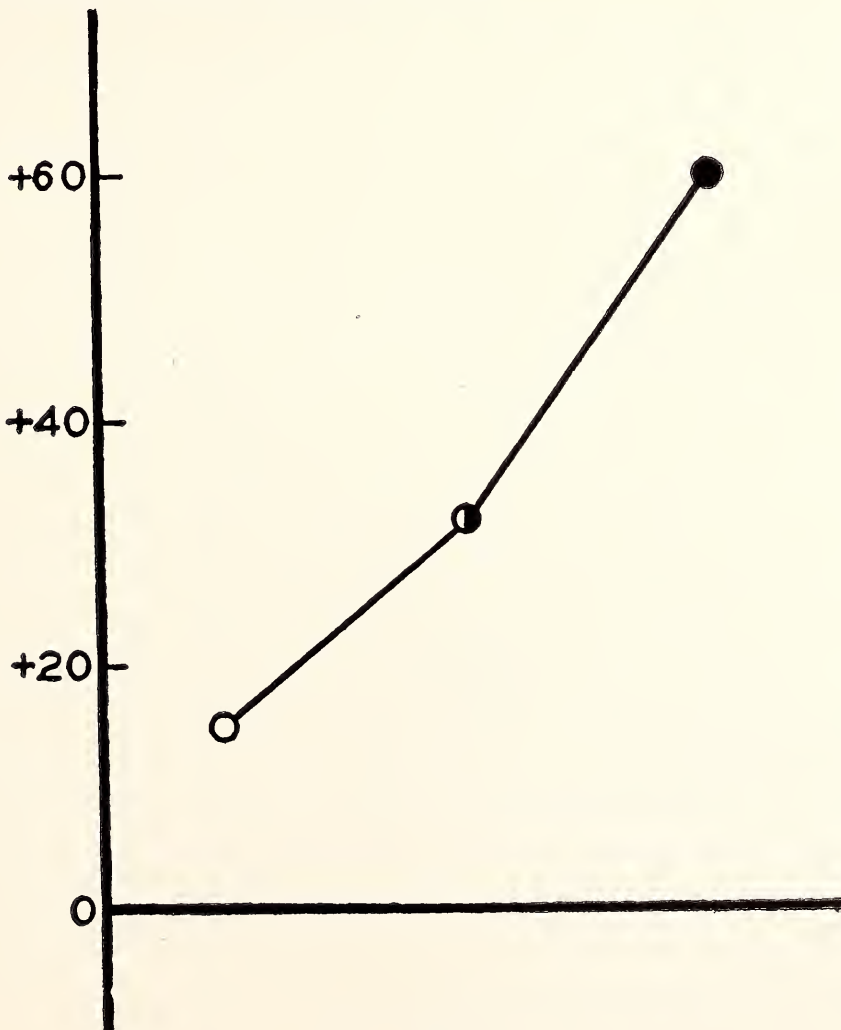


Figure 41

Warden opinion of beaver population trends.

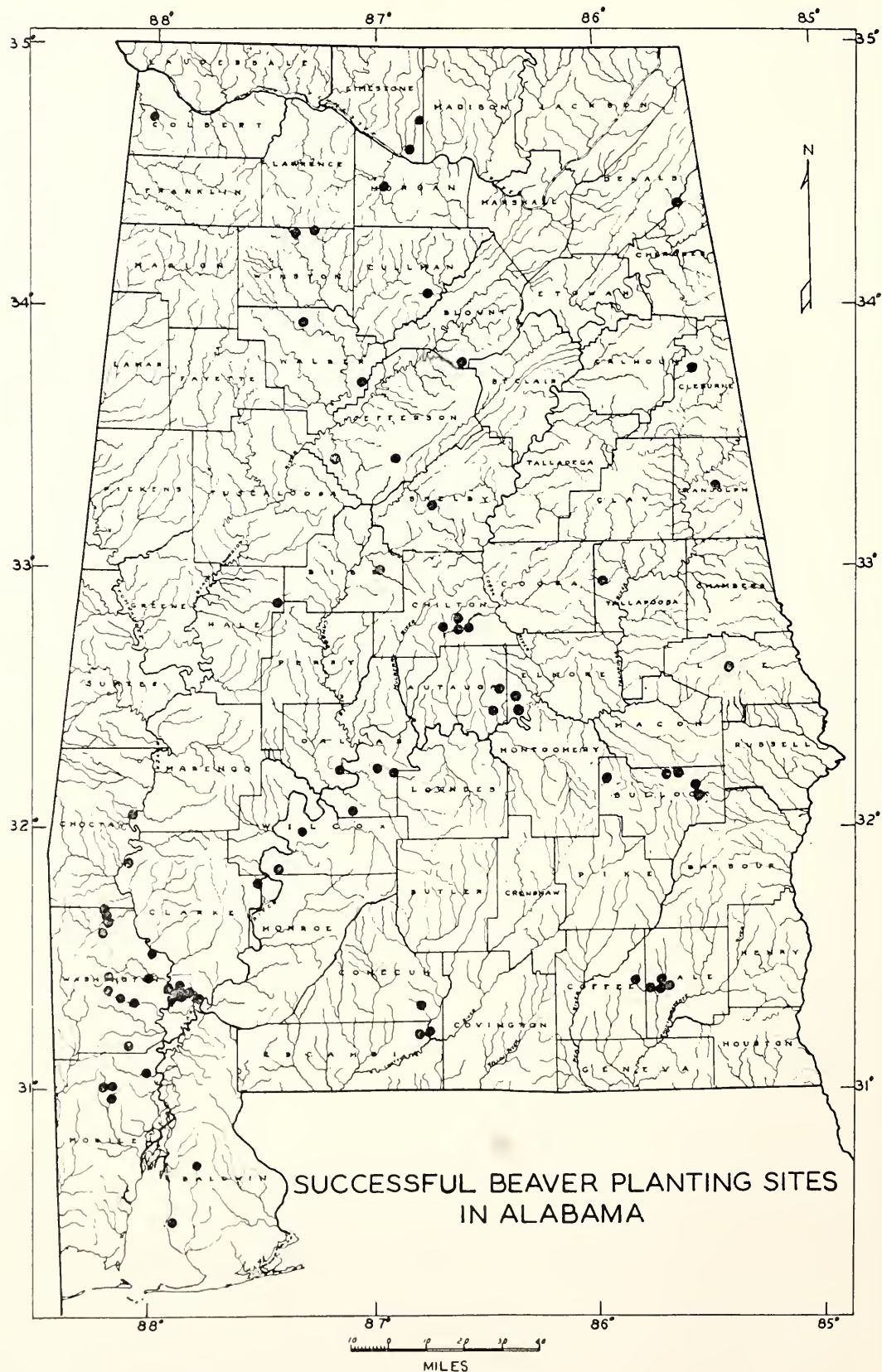


Figure 42

With the institution of a completely closed season on beaver trapping in the fall of 1938, the species rapidly increased and by 1941 its numbers were greater than at any time during the past 50 years. Through restocking efforts and natural dispersal, beavers were present and increasing in 40 counties in 1944. Figure 41 represents the trend of the beaver population correctly.

III. BEAVER LIVE-TRAPPING RESULTS

The preliminary findings of the beaver surveys indicated that the extermination of these animals in most areas was caused by overtrapping. A Pittman-Robertson live-trapping and transplanting program was begun in June, 1940, and continued until December, 1944. During this period, 398 animals were taken in Bailey live traps (Fig. 43), and 333 (83.67 per cent) of them were successfully released in 72 different locations* in the State (Fig. 42). Beaver colonies were established at or near each of the release sites. The 100 per cent success of the beaver "plants" confirmed our opinion that man was responsible for the extirpation of this species throughout most of its Alabama range.



Figure 43

Unbaited Bailey live trap set in a beaver canal.

*See Appendix (pp. 134-6) for location of release sites.

Fifty-six (14.07 per cent) died from various causes, and 9 (2.26 per cent) escaped from the holding pens. The same trapper and the same type of traps were employed throughout the project's duration. From six to eight unbaited traps were set daily in beaver canals or where "slides" entered the water. Considerable care in the selection of these sites was exercised by the trapper.

It was known that the beaver population was steadily increasing (Fig. 41) and it was hoped that the per cent of successful traps would provide an index for evaluating this increase. Unfortunately, it did not.

Column IV of Table VII and Fig. 44 show that the "Per Cent of Traps Successful" in catching beaver was approximately the same in 1940 (3.76), 1941 (3.83), and 1942 (3.08). There was a slight increase in 1943 (4.69), and a large increase in 1944 (6.77).

$$\text{Per Cent of Traps Successful} = \frac{\text{Total Beaver Caught} \times 100}{\text{Total Number of Trap Nights}}$$

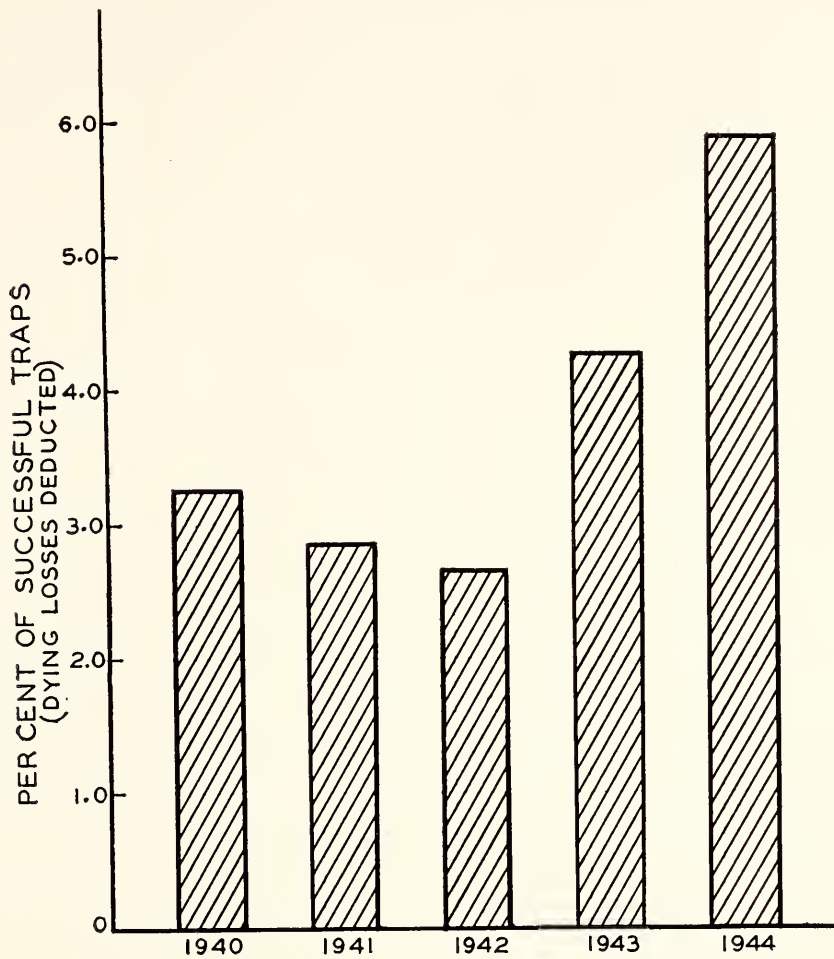
$$\text{Per Cent Mortality*} = \frac{\text{Total Number Beaver Dying} \times 100}{\text{Total Number of Beaver Caught}}$$

$$\text{Trapping Success**} = \frac{(\text{Number Beaver Caught} \times 100) \times (100 - \text{Per Cent Mortality})}{(\text{Number of Trap Nights})}$$

The failure of the "Per Cent of Traps Successful" to give an index for calculating the population is due to the method of trapping. Traps were set in only one colony or colony groups at a time, the population of which varied from 6 to rarely more than 12 animals. Bradt (1947) pointed out that the two year old beavers were driven from the colony each year prior to the arrival of the next litter, and that these two year olds dispersed in all directions. While the population is relatively low compared to the carrying capacity of the range, there would be little chance of two years olds from nearby colonies passing through the colony area being trapped, and therefore the per cent of successful traps would be about the same since the population remained static within each colony. In 1943 and 1944, the beaver population had increased to such an extent

*Table VII, Column V; also Table VIII, Column V.

**Table VII, Column VI; also Table VIII, Column VI.



BEAVER TRAPPING SUCCESS BY YEARS

Figure 44

TABLE VII

BEAVER TRAPPING SUCCESS BY YEARS

Year	I Beaver Caught	II Beaver Dying	III Trap Nights	IV Per Cent of Traps Successful	V Per Cent Mortality	VI Trapping Success
1940	22	3	585	3.76	13.64	3.25
1941	63	16	1,644	3.83	25.40	2.86
1942	77	10	2,502	3.08	12.99	2.68
1943	99	9	2,113	4.69	9.09	4.26
1944	137	18	2,023	6.77	13.14	5.88
Total	398	56	8,867	4.49	14.07	3.86

that there were large numbers of two year olds as well as older animals seeking better sites, and as they moved through colonies being trapped, many of them were caught. This was reflected by the increase of "Per Cent of Traps Successful" in 1943 and 1944. It is also probable that, due to crowding, there was a slight increase in the number of beavers per unit area, but this is believed to be a secondary factor.

There is a considerable amount of variation in the per cent of successful catches from one season to the next. Table VIII and Fig. 45 show these fluctuations. Figure 45, the quarterly trapping success, was plotted from the data of Table VIII. Figure 46 shows the trapping success (Column VI of Table IX) by months and grouped by quarters. It is obvious from Column IV, Table IX, that during the months of September, October, and November there is considerably more activity in the beaver population than at other times. Figure 47 was plotted from data in Column IV, Table X, to determine if the peak shown in July (Fig. 46) was due to some increase in beaver activity. In every year, the July trapping success was higher than either June or August. Since the number of animals handled in any one month is small, the July peak may be due to an error of sampling, however, the possibility of increased beaver activity during July must be considered. We do not have sufficient data to settle this point.

Table XI and Figure 48 show the factors causing mortality in beavers trapped. Since the majority of streams on which we trapped were subject to rapid rises, and since their sandy bottoms did not provide sufficiently firm substrata for staking the traps down, many beavers were lost by struggling in the traps, turning them over, and drowning. In the holding pens, the majority of deaths resulted from trap injuries. In many cases we could not tell whether the animal had been injured by the trap or succumbed from other causes, and for this reason trap injury losses were grouped with losses resulting from confinement. Transportation losses were caused by excessive heat. Six animals apparently died from shock; since this could not be positively determined, the cause of death was listed as "Unknown." Only one animal was lost by fighting with another beaver and one pregnant female aborted and died shortly afterward. Three animals were lost from exposure when the

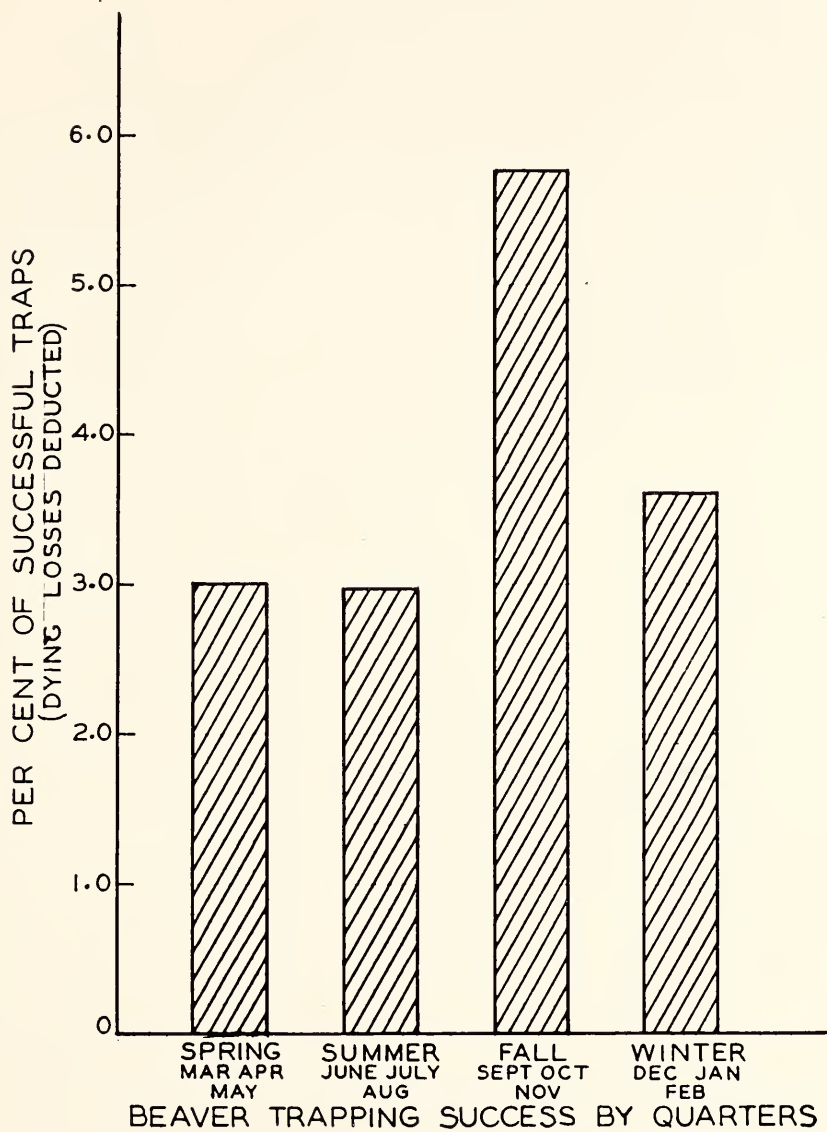


Figure 45

TABLE VIII

BEAVER TRAPPING SUCCESS BY QUARTERS

Quarter	I Beaver Caught	II Beaver Dying	III Trap Nights	IV Per Cent of Traps Successful	V Per Cent Mortality	VI Trapping Success
Spring	79	16	2,102	3.76	20.25	3.00
Summer	75	9	2,228	3.37	12.00	2.97
Fall	149	17	2,288	6.51	11.41	5.77
Winter	95	14	2,249	4.22	14.74	3.60

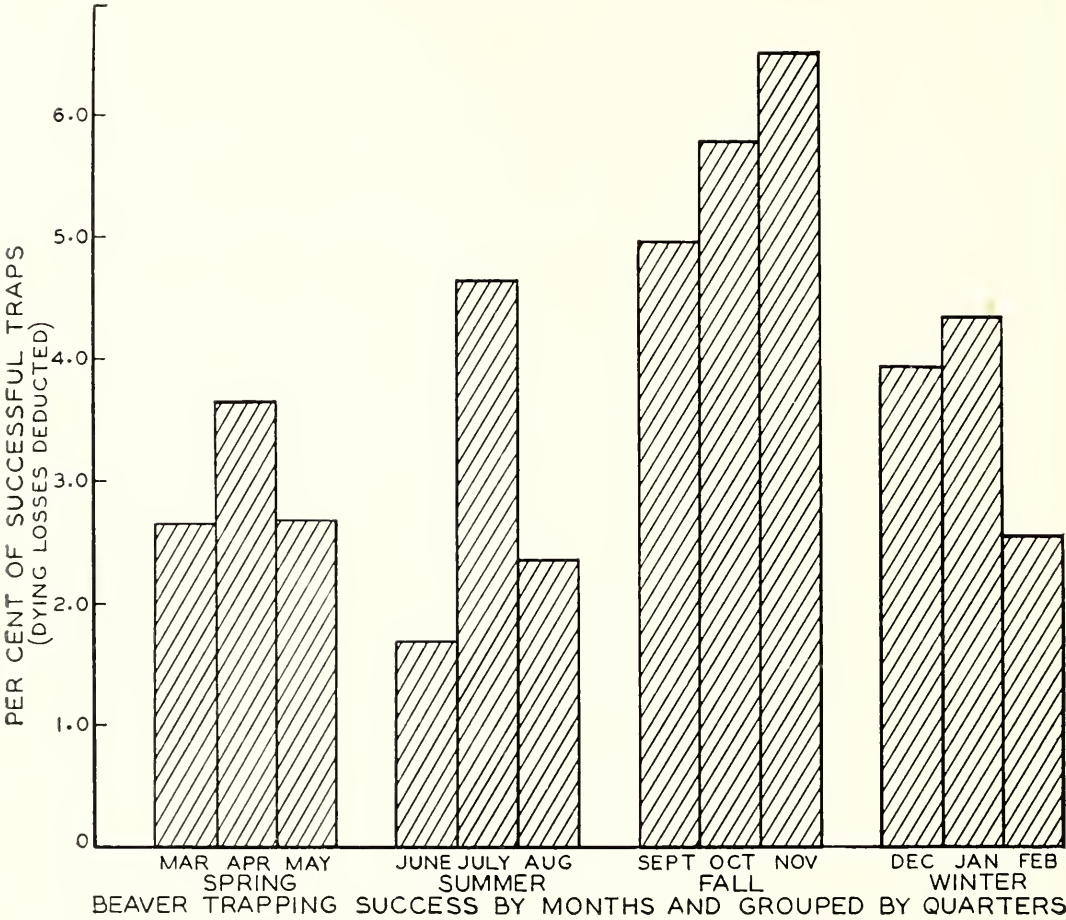


Figure 46

TABLE IX

BEAVER TRAPPING SUCCESS BY MONTHS AND GROUPED BY QUARTERS

Month	I Beaver Caught	II Beaver Dying	III Trap Nights	IV Per Cent of Traps Successful	V Per Cent Mortality	VI Trapping Success
March	23	5	683	3.37	21.74	2.64
April	29	3	710	4.09	10.34	3.67
May	27	8	709	3.81	29.63	2.68
June	14	3	649	2.16	21.43	1.70
July	39	3	776	5.03	7.69	4.64
August	22	3	803	2.74	13.64	2.37
Sept.	44	7	745	5.91	15.91	4.97
Oct.	50	6	759	6.59	12.00	5.80
Nov.	55	4	784	7.02	7.27	6.51
Dec.	38	5	831	4.57	13.16	3.97
Jan.	32	4	647	4.95	12.50	4.33
Feb.	25	5	771	3.24	20.00	2.59

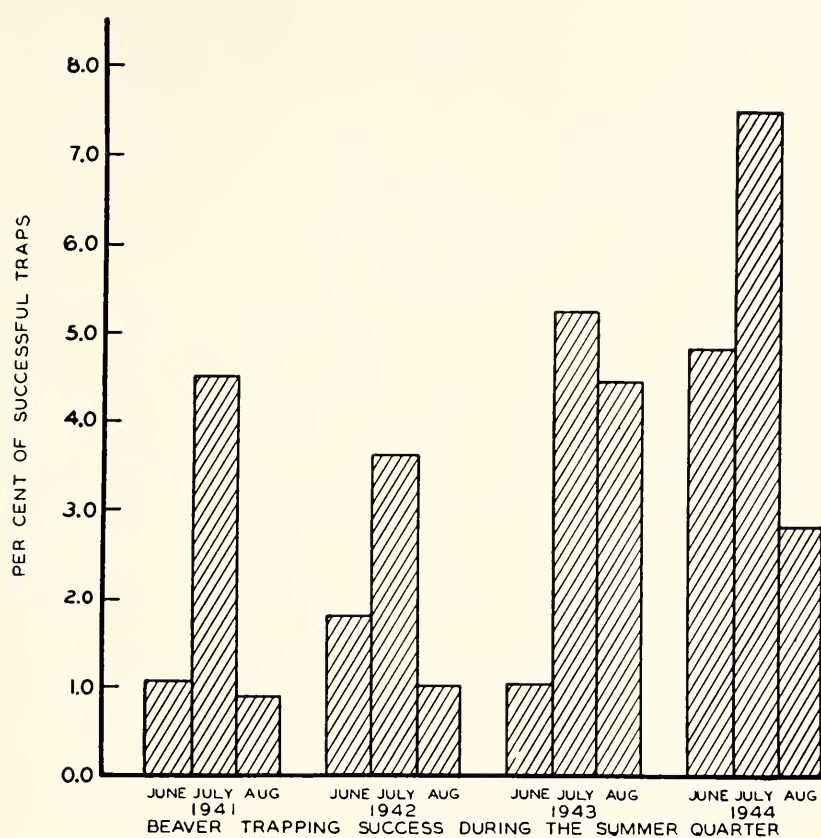


Figure 47

TABLE X

TRAPPING SUCCESS DURING THE SUMMER QUARTER

Year	Month	I	II	III	IV	V	VI
		Beaver Caught	Beaver Dying	Trap Nights	Per Cent of Traps Successful	Per Cent Mortality	Trapping Success
1941	June	1	0	92	1.09	0.00	1.09
	July	6	1	133	4.51	16.67	3.76
	Aug.	1	0	111	0.90	0.00	0.90
1942	June	4	0	221	1.81	0.00	1.81
	July	9	0	248	3.63	0.00	3.63
	Aug.	2	1	199	1.01	50.00	0.50
1943	June	2	1	191	1.05	50.00	0.52
	July	11	1	210	5.24	9.09	4.76
	Aug.	10	1	223	4.48	10.00	4.03
1944	June	7	2	145	4.83	28.57	3.45
	July	13	1	173	7.51	7.69	6.93
	Aug.	5	0	177	2.83	0.00	2.83

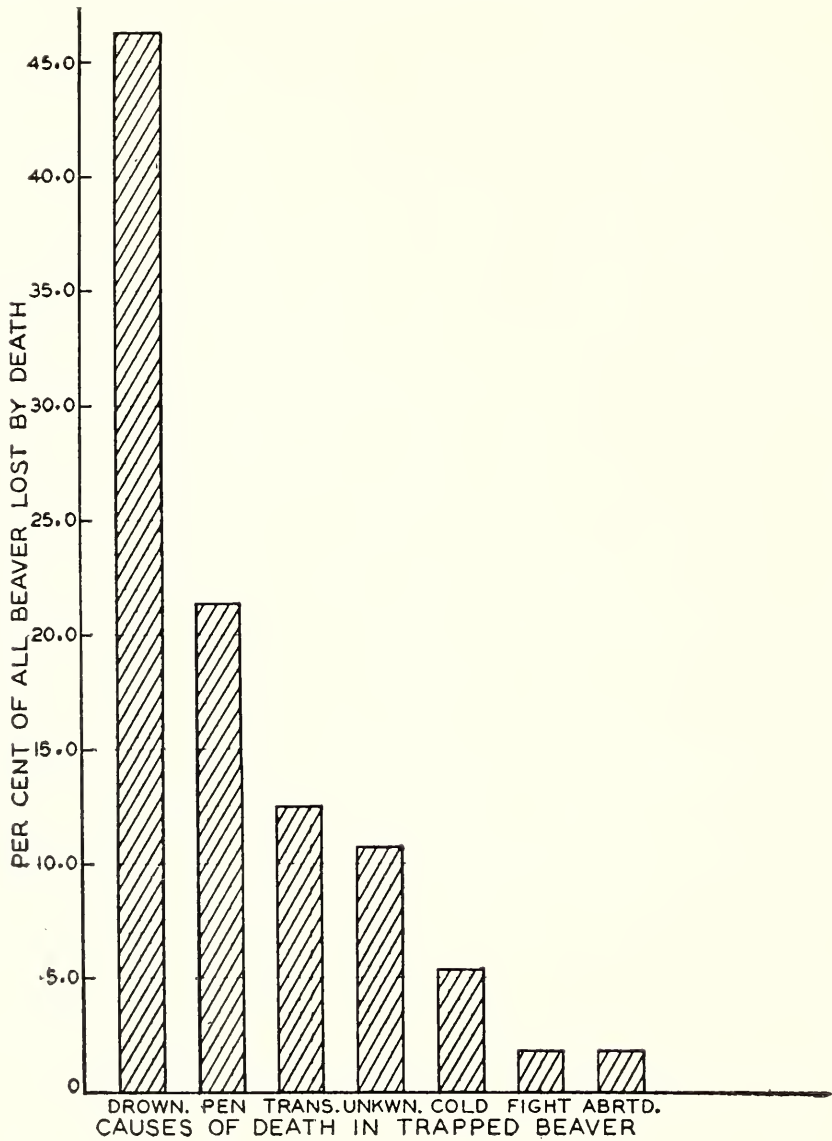


Figure 48

TABLE XI

CAUSES OF DEATH IN TRAPPED BEAVER							
	Drowning	Pen*	Trans- port	Unknown	Cold	Fighting	Aborting
Number of Beaver Dying	26	12	7	6	3	1	1
Per Cent of Total Dying	46.43	21.43	12.50	10.71	5.35	1.79	1.79

*The majority of these animals died in pen from trap injuries.

temperature dropped below freezing while they were in the traps.

SUMMARY AND CONCLUSIONS

The "Per Cent of Traps Successful" will not provide a useable index for determining the increase or decrease in a beaver population. Beavers are more active in the fall than at any other time of the year.

An increase of 300 or 400 per cent in the beaver population will be reflected in the "Per Cent of Traps Successful," but such an increase is so easily seen by casual observations that this index has few practical applications.

November was found to be the optimum month in which to trap and transplant beavers. Compared with the cost of fall (Sept., Oct., Nov.) trapping and transplanting, the summer quarter was 94 per cent higher, the spring quarter 92 per cent more, and the winter quarter was 63 per cent greater.

THE RABBIT INVENTORY

I. CENSUS TECHNIQUES

DRIVE CENSUS

In the drive on Chewacla State Park (p. 25), a total of 281 rabbits was counted. Securing an accurate count on the area was difficult because of the heavy grass (Fig. 49) and denseness of the vegetation in many areas. Some rabbits flushed ahead of the line and sneaked off the area before being seen by the drivers while others became frightened and doubled back through the line. In spite of these factors, we were of the opinion that the population of 281 was very close to accuracy.

During the dog census of the park, 12 rabbits were seen by the research men. It would appear that since there were approximately 281 rabbits on the area and 12 of them were seen during the dog census, an index figure of 23 could be used for determining rabbit populations on similar areas during dog quail census work. Such an index is, in my opinion, worthless. It is readily seen that by observing only two additional rabbits (which happened on a later check) a considerable error is introduced. Anyone who has hunted with bird dogs has observed that on some days most dogs will point a few rabbits, but at other times they will not pay the slightest attention to them. This variable alone is sufficient to make such a method invalid. The number seen per unit of time will not even give an indication of relative abundance. On one area hunted, 5 rabbits were seen, yet, one week later using the same dogs, 29 rabbits were flushed on only 75 per cent of the same range.

Summary of Drive Census

As a result of this drive and subsequent work on the State Park we concluded that an accurate population estimate of the number of rabbits present cannot be obtained by multiplying the number of rabbits seen during a dog census by an index number. The number of animals flushed by dogs per unit of time is equally worthless.

FLUSHING DISTANCE METHOD

On finding that the number of rabbits seen during a dog census was not correlated with the total number present, we tried a modification of King's (1937) method. The average flushing distance on all rabbits jumped by the research personnel during the quail census work was recorded. This distance was taken to be the shortest distance between the flushing point and the line of walk. Averaging all distances gave a figure of approximately 5 feet. Pedometers were used to determine the distance traveled. Multiplying this by 10 (twice the average flushing distance) we hoped to get rabbit population data at the same time information was secured on quail. This method "worked" considerably better in the office than in the field. The pedometers gave reasonably accurate measurements only on relatively smooth ground, and the flushing distances varied with the weather, the time of the day, and the differences in vegetation.



Figure 49

Securing an accurate count of rabbits in high grass and briars is difficult.

Summary of Flushing Distance Method

This technique was not tested sufficiently to conclude that it is completely worthless, but all the results obtained indicated that it had little value in the Southeast. The index of rabbit abundance discussed by A. Leopold and Anderson (1938) was not tested since it could not be used at the same time we were making a dog census for quail.

PELLET COUNT

A modification of the pellet count method used by Hendrickson (1939) in Iowa and by Trippensee (1938) in Michigan was tried. By dropping a 1/2000 of an acre hoop at regular intervals along a cruising line and counting the number of times pellets occurred in it, we hoped to obtain an index of the rabbit population in an area. A check plot was set up, and a number of animals were live trapped and tagged, but the project had to be abandoned before conclusive evidence could be secured. Although the data secured was limited, it appeared that the pellet frequency method under the variable climatic conditions in the Southeast is of little value for determining the abundance of rabbits.

II. TRENDS

Information on fluctuations in the rabbit population was obtained from the Warden Game Trend Questionnaires and the Personally Administered Questionnaire survey. These questionnaires were evaluated in the same manner as those for quail (p. 36).

Although there are five representatives of the genus *Sylvilagus* found in Alabama, the eastern cottontail (*Sylvilagus floridanus mallurus* Thomas) and the swamp rabbit (*Sylvilagus aquaticus aquaticus* Bachman) make up 95 per cent of the total rabbits killed there each year. The subspecies *mallurus* alone comprises over 80 per cent of the annual bag. The New England cottontail (*Sylvilagus transitionalis* Bangs) is known from only two specimens taken by Howell in 1912 in Cullman and Clay Counties. The Erin specimen, identified by Howell (*ibid.*) as *Sylvilagus transitionalis* Bangs, is actually *Sylvilagus floridanus*

mallurus Thomas. *Sylvilagus aquaticus littoralis* Nelson is found only in the marshes and along the streams in southwestern Alabama. *Sylvilagus palustris palustris* Bachman occurs in the southern tier of counties from the Georgia line to the eastern shore of Mobile Bay where it is abundant in the marshes and swamps. It furnishes little sport, however, since it inhabits areas almost completely shunned by hunters.

Figure 50 actually represents the trend of *Sylvilagus floridanus mallurus*. The +19 rating obtained from the Personally Administered Questionnaires does not seem to agree with the -7 report of the game wardens. This discrepancy is discussed on pages 40-2. There was a sharp drop in the rabbit population in certain areas of Alabama during 1941, but in others the population remained about the same. A decrease in the hunting pressure in 1941-42 is believed responsible for the increase that season.

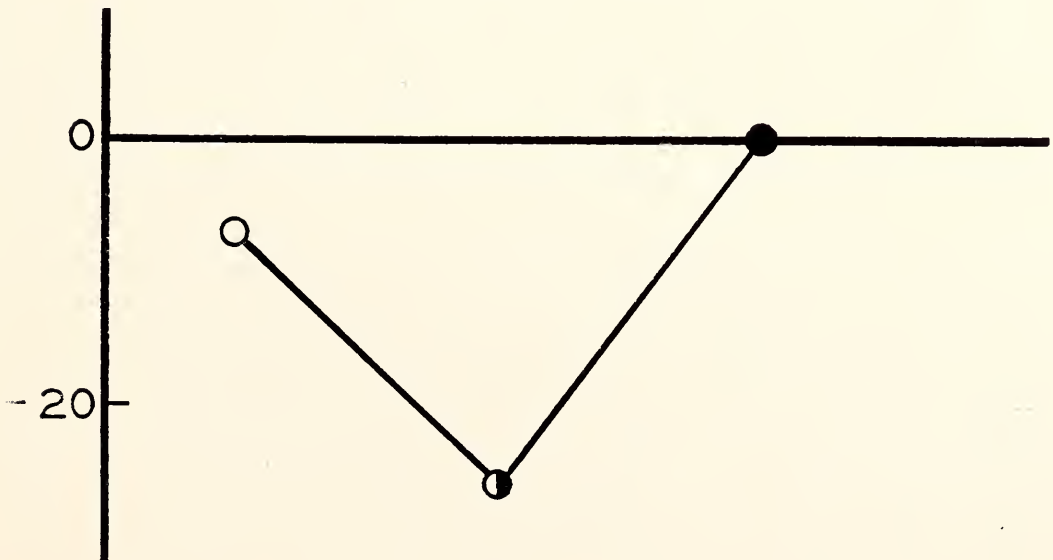


Figure 50

Warden opinion of rabbit population trends.

THE SQUIRREL INVENTORY

I. CENSUS METHODS

A limited amount of time was spent by the inventory personnel in trying to develop a satisfactory technique for making a state-wide census of the gray squirrel, *Sciurus carolinensis carolinensis* Gmelin. The only ones that seemed to be adaptable to Alabama conditions were (1) the time area count and (2) leaf nest counts. Since squirrels were not given primary consideration, these two methods were not tested sufficiently to make anything but tentative statements concerning their possible value.

TIME AREA COUNT

This method was tested on 3 plots of 2.2 acres each in Dale County. The technique proposed by Goodrum (1940) was not applicable to conditions on these areas because the squirrels would remain hidden for some time after the observer entered the plot. Various length of observation periods were tried, but the only one giving reasonably consistent results was a 15 minute count which began when the first squirrel appeared. It was found necessary to wait sometimes two hours before squirrels became active, but after the first one "stuck his neck out" all the others would readily follow his example. Day-break and late evening counts in December* were about the same, but during the middle of the day counts were erratic and almost never as high as those made in the early morning or late afternoon. After the above modification had been made, fairly consistent counts were made for several days; then all the squirrels moved out of the check areas completely.

CONCLUSIONS

This method has some value, but it is time consuming. Because of the small amount of territory that can be censused each morning and afternoon, it is impractical for obtaining a density index on large areas.

*In May the maximum activity seemed to be between 7 and 8 o'clock in the morning.

LEAF NEST COUNT

The leaf nest count seems to be the most practical method for obtaining density indices on large areas. Baumgartner (1938) found that the number of active leaf nests in a woodlot was approximately equal to the adults of the fox squirrel population. Goodrum (*ibid*) applied the same index to a determination of the gray squirrel population in Texas.

In order to determine the validity of the index in Alabama, trapping operations were carried out on a pine-oak-hickory woodlot on the Alabama Polytechnic Institute Experiment Station from April 30 to May 14, 1940. Eighty-nine captures representing 22 different gray squirrels were taken in live traps baited with pecans. On May 14, the day trapping was discontinued, 21 active leaf nests were present on the plot, an average of one squirrel per .99 nests. This figure of 1.01 squirrels per nest agrees closely with Baumgartner's findings which were also based upon exhaustive trapping and tagging.

Immediately after the close of the hunting season, many nests are present but the occupants have been killed. Inclusions of these nests in a census would lead to a serious error in computing the remaining population. In a study to determine the length of time required for abandoned nests to deteriorate sufficiently to be recognized as such, 104 nests on the A. P. I. Experiment Station were kept under observation from February to June. They were periodically examined and their condition noted. Data were recorded on 25 known to have been active and subsequently deserted. It was found that, on the average, 52 days after a nest was abandoned it disappeared or deteriorated sufficiently not to be confused with those in use.

Unused nests situated in unprotected places disappear in a few weeks while nests placed in crotches of trees where they are protected from wind and rain may last for three or more months. However, a 50 to 60-day interval between the close of the hunting season and the time of the census will allow nests adequate time to lose their characteristic appearance and thus be eliminated from the census.

The nest count can be utilized more effectively during the winter months when the absence of foliage enables an observer to count all outside nests without difficulty.

We desired to check the leaf count method in all parts of the State, and in various types of timber but the expense involved was prohibitive at that time.

CONCLUSIONS

1. The leaf nest count is more practical than the time area count for making state-wide squirrel inventories. It is believed better to consider the number of nests per unit area to be a density index rather than an actual population estimate. The number of leaf nests seems to vary inversely to the number of den trees available.
2. The adult gray squirrel population on the experimental area was approximately the same as the number of active leaf nests.
3. A census, using leaf nest counts, is best undertaken during the winter months.
4. In order to give abandoned nests sufficient time to deteriorate, counts should not begin earlier than 50 days after the close of the hunting season.

II. TRENDS

METHODS USED

Trends in the gray and fox squirrel populations were obtained in the same manner as were the trends for quail; namely, by the Personally Administered Questionnaire, Part 2 (p. 34), and by use of the Warden Game Trend Questionnaires (p. 35).

RESULTS

Two forms of gray squirrels occur in Alabama, (a) *Sciurus carolinensis carolinensis* Gmelin, distributed throughout the State except in the swamps of the extreme southwestern portion, and (b) *Sciurus carolinensis fuliginosus* Bachman, which is found in the river and deep cypress swamps of Mobile, Washing-

ton, and Baldwin counties, a restricted distribution. Figure 51 below actually represents the trend of the subspecies *carolinensis*.

Gray Squirrel

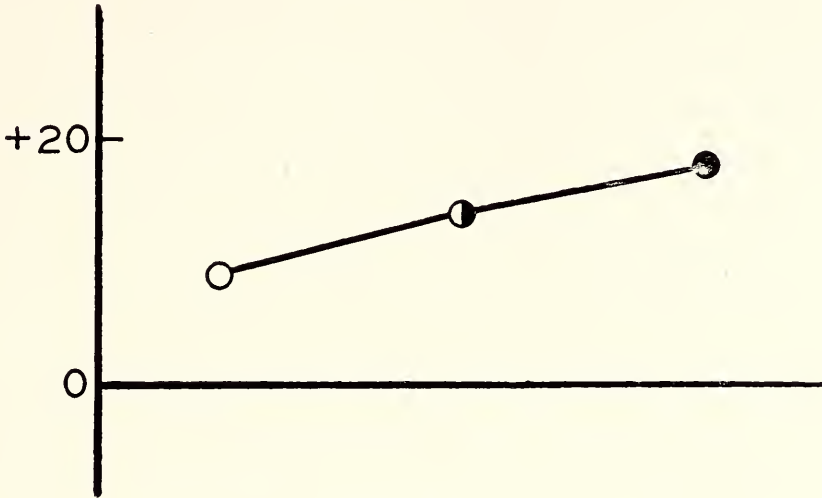


Figure 51

Warden opinion of gray squirrel population trends.

There appeared to have been little change in the gray squirrel population during the period of the inventory, and Fig. 51 tends to confirm our field observations. The warden questionnaire report of +9 and the +2 return from the Personally Administered Questionnaire survey seem to agree.

Fox Squirrel

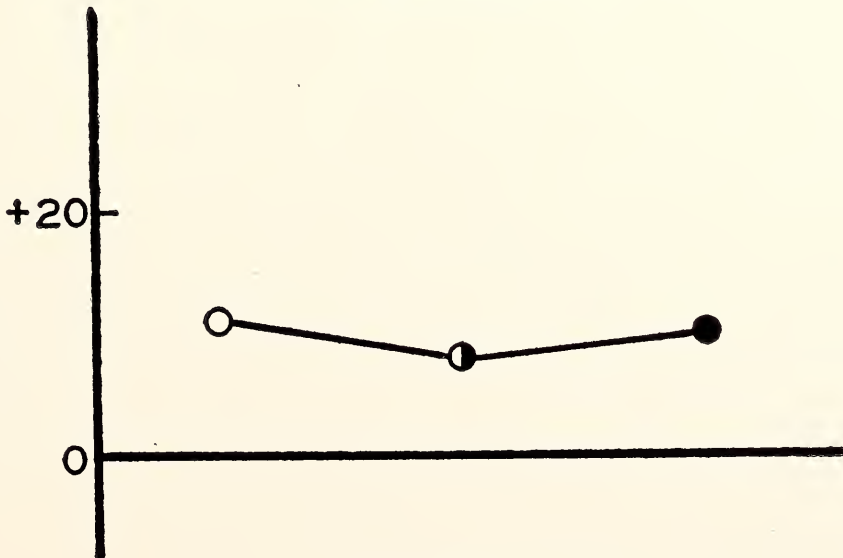


Figure 52

Warden opinion of fox squirrel population trends.

Two subspecies of the fox squirrel occur in Alabama, (a) *Sciurus niger niger* Linn, and (b) *Sciurus niger texianus* Bachman. The subspecies *niger* is limited to the southeastern corner of the State while *texianus* occurs throughout the rest of Alabama. This species is not abundant and provides only a limited amount of hunting. Our observations indicated that there was almost no fluctuation in the population during the three year period. Figure 52 seems to confirm our observations. The +11 Warden Game Trend Questionnaire result agrees closely with the +8 report obtained from the Personally Administered Questionnaire survey.

CONCLUSIONS

During the period of the inventory there were no marked fluctuations in the populations of either the fox or gray squirrel.

TRENDS OF OTHER GAME SPECIES

The trends of each of the following species were obtained from Warden Game Trend Questionnaires and from the Personally Administered Questionnaire, Part 2. The procedure used in evaluating these questionnaires is described in detail in the section on quail, pages 36-9.

I. MOURNING DOVE

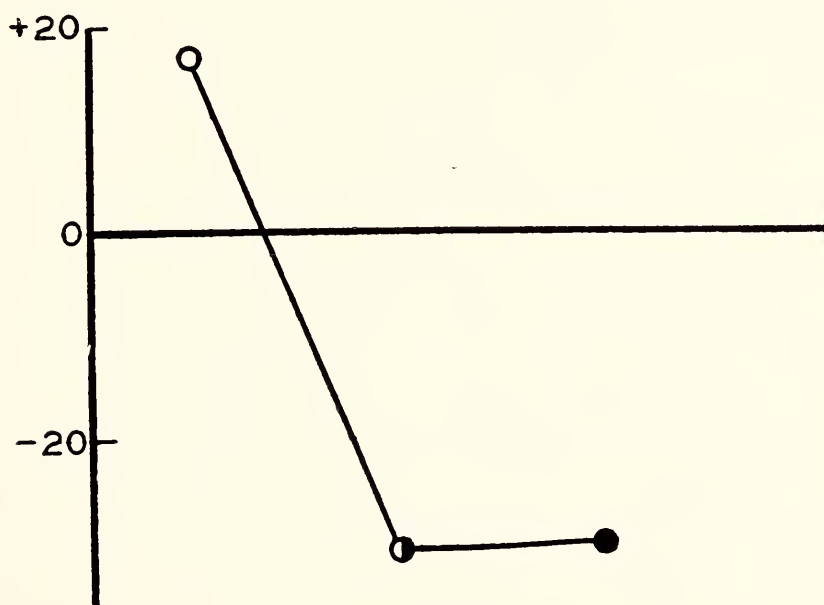


Figure 53

Warden opinion of mourning dove population trends.

The dove (*Zenaidura macroura* sp.) population during the 1939-40 season was below that which wintered in Alabama some ten years before, but when compared with 1938-39 there was a slight increase. In 1940-41 the number of resident and non-resident birds was far lower than had ever been recorded. This drop is reflected in Fig. 53. There was almost no increase in 1941-42 and the "No Change" report indicated above is believed to represent the trend correctly. According to Pearson (1943, 1944) there was a progressive increase in the dove population in 1943 and 1944. It appears that the low point in the dove population in Alabama was in 1941 and 1942. The Personally Administered return of -20 compared with that of +17 obtained from the wardens was discussed on pages 40-2.

II. OPOSSUM

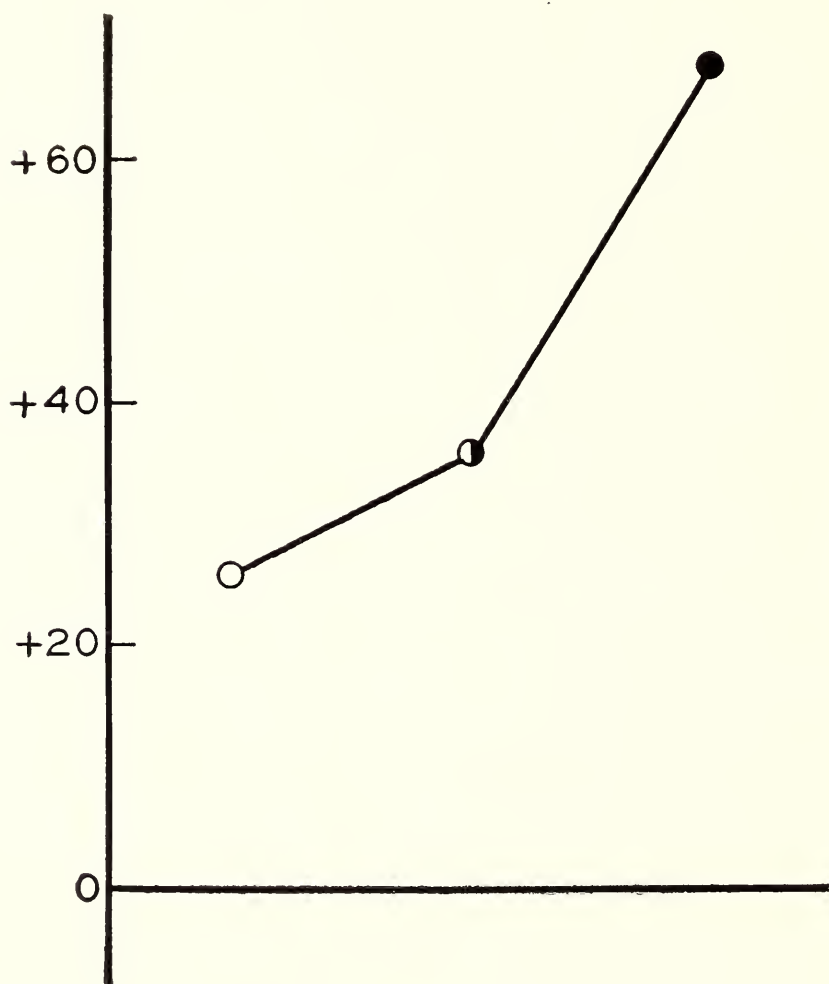


Figure 54

Warden opinion of opossum population trends.

Low fur prices and a decrease in hunting pressure due to the number of individuals employed in "war work" and military service will account for the increase in the opossum population. There is, in my opinion, only one form of the opossum in the State, *Didelphis virginiana virginiana* Kerr. Figure 54 depicts the trend correctly; the +30 report from the farmers and the +26 result from the warden questionnaires are in close agreement.

III. GRAY FOX

There was a sharp increase in the gray fox (*Urocyon c. cinereoargenteus* Schreber) population as indicated by the warden reports. Both rabies and distemper were reported in the species in 1941, but it was apparently not extensive enough to reduce the population appreciably. The \$1.00 tax on fox hides, in Alabama, and low fur prices have discouraged almost all fox trapping. Fox hunters do not, as a rule, kill them. Therefore, they have almost no effective enemies in Alabama. The farmer (+67) and the warden(+57) reports are in agreement on the fox population trend.

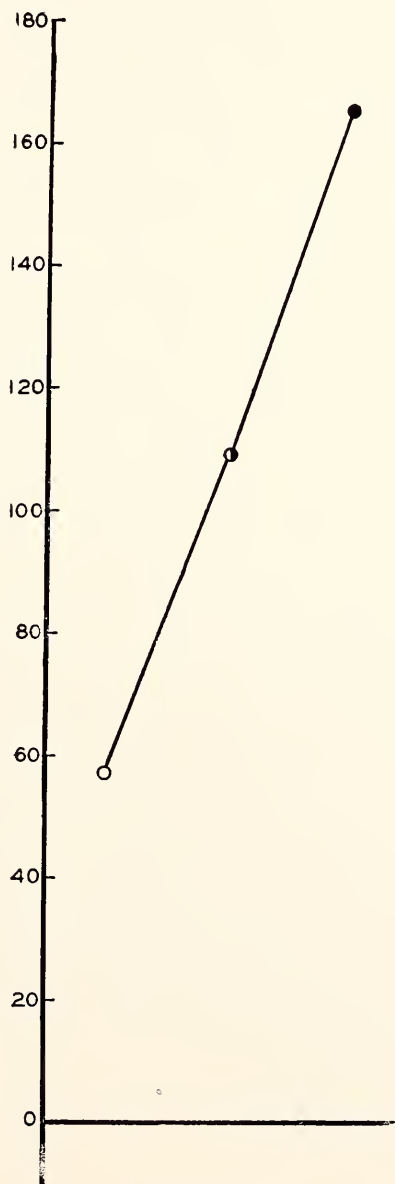


Figure 55

Warden opinion of gray fox population trends.

IV. RED FOX

The red fox, *Vulpes fulva* Desmarest, was introduced into Alabama by the fox hunters and has become established in every county. Red foxes increased steadily during the inventory period. While not as numerous as gray foxes, they are in sufficient numbers to be a serious nuisance to the farmer. Their effect on all game species is probably considerable, but this was not possible to evaluate during the short period of work. "Reds" have fewer effective enemies than "Grays" for they readily evade fox hounds and are not as easily trapped or hit by automobiles. A few instances of rabies in this species were reported in 1941. The warden report of +31 and the Personally Administered Questionnaire return of +52 are in agreement.

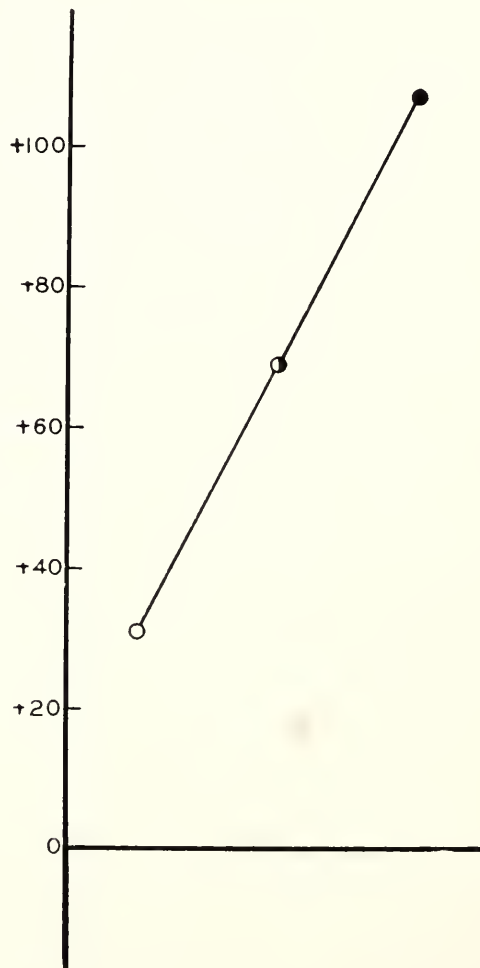


Figure 56

Warden opinion of red fox population trends.

V. RACCOON

The raccoon, *Procyon lotor varius* Nelson and Goldman, increased greatly during the survey period. The low value of raccoon pelts made trapping impractical from 1939-1942. Reduced hunting pressure in 1941-42 was also a contributing factor. The Personally Administered Questionnaire result of +29 and the report from the game warden of a 21 county increase are in close agreement.

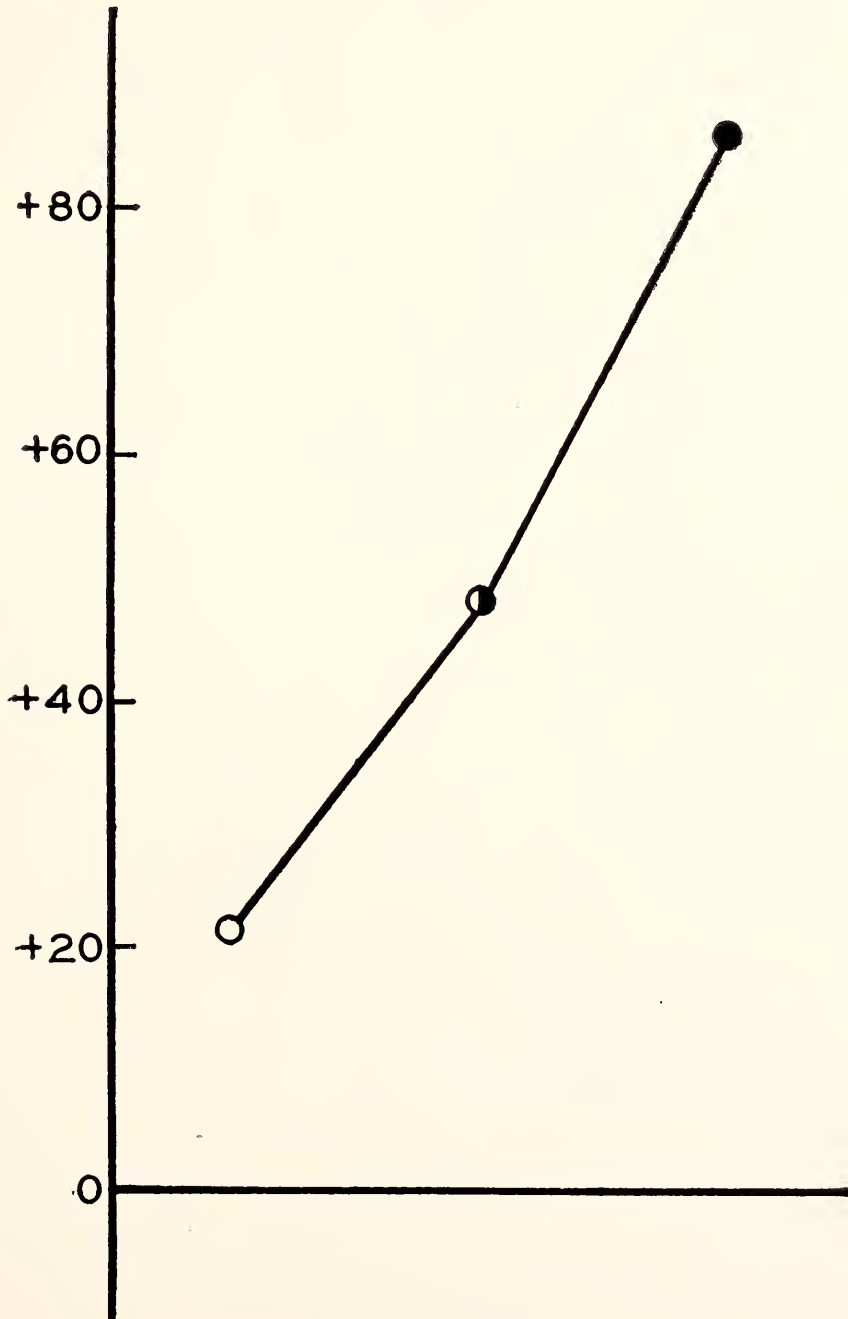


Figure 57
Warden opinion of raccoon population trends.

VI. BLACK BEAR

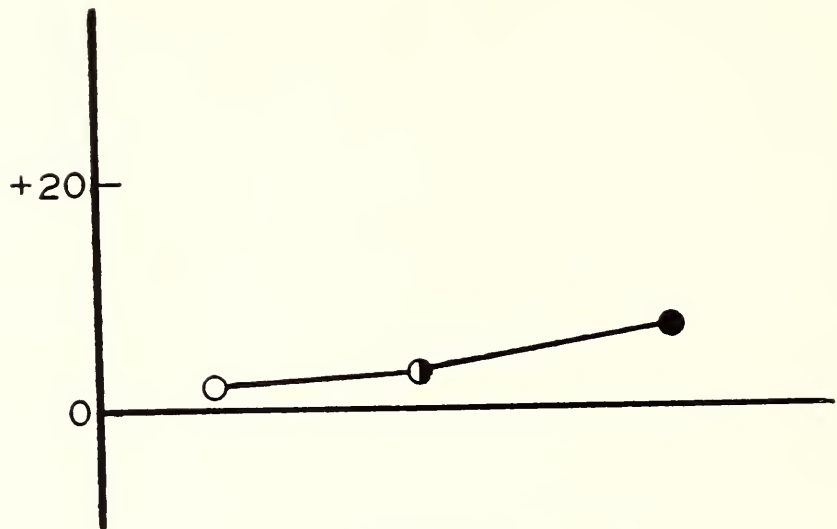


Figure 58

Warden opinion of black bear population trends.

The Florida black bear, *Ursus floridanus* Merriam, has increased since being protected by a completely closed season in 1940. The species is present in 4 and possibly 5 counties in the southwestern corner of Alabama. The increase of +1 reported by the landowners and the +2 increase from the warden questionnaire are in agreement.

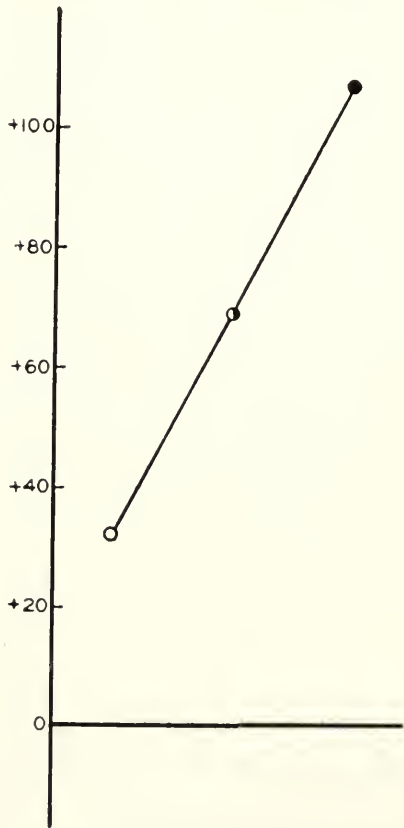


Figure_59

Warden opinion of muskrat population trends.

VII. MUSKRAT

Two subspecies of muskrats occur in Alabama. *Ondatra zibethica rivalicia* Bangs occurs in the marshes of Mobile and Baldwin Counties, and *Ondatra zibethica zibethica* Linnaeus is found throughout the rest of the State. It is very scarce in the southern tier of counties and its presence in some is doubted. The trapping season was closed during the winters of 1938-39 and 1939-40. The increase in the 'rat population until the fall of 1940 may be attributable to this fact. The season was opened in all

counties except Baldwin and Mobile, both in 1940-41 and 1941-42, but low fur prices the first year and the few trappers the second season probably accounts for the continued increase as indicated in the warden reports. Both the farmer (+37) and warden (+32) reports agree.

VIII. SKUNK

Two subspecies of skunks, *Mephitis m. nigra* Peale and Beauvois and *Mephitis m. elongata* Bangs, occur in Alabama. The first one is found in every county of the state. The latter form is limited to the Gulf coastal region. The increase in both subspecies may be attributed to low fur prices and decreased trapping pressure. The +15 increase reported by the wardens and the +13 obtained by the inventory personnel in the questionnaire survey of the farmers are in agreement.

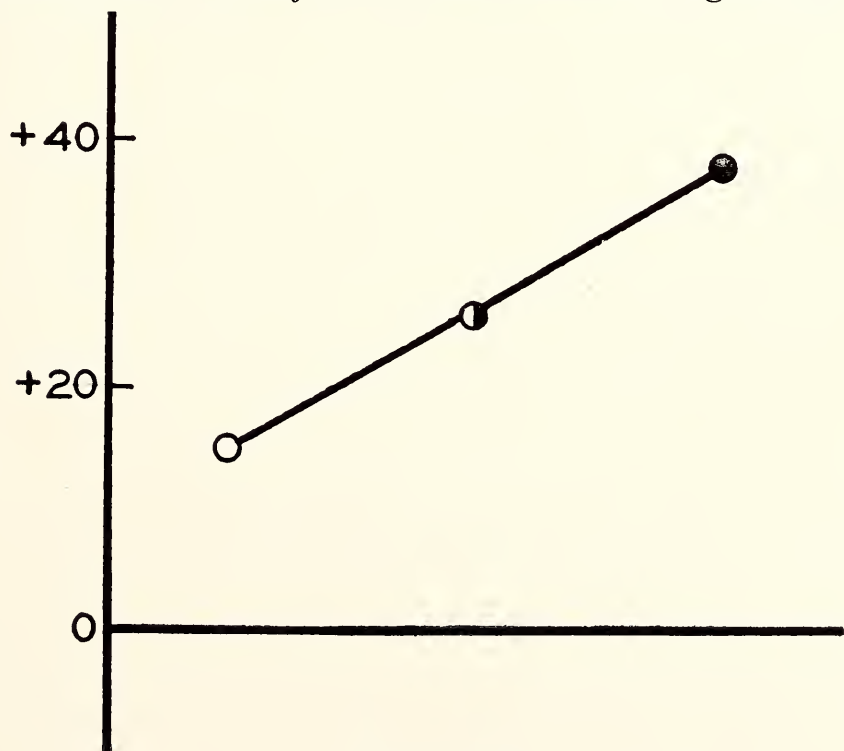


Figure 60
Warden opinion of skunk population trends.

IX. POLE CAT

The little "Civet Cat," *Spilogale putorius* Linnaeus, also occurs in all counties of Alabama, but it seems to be less abundant in the coastal counties and those of the Tennessee Valley than in other parts of the State. Its increase is also due to a lessening of the trapping pressure. This increase seems to have been more general in 1939, 1940, and 1941 than that reported

in the skunk. The warden opinion (+22) and the farmer (+24) results seem to be in close accord.

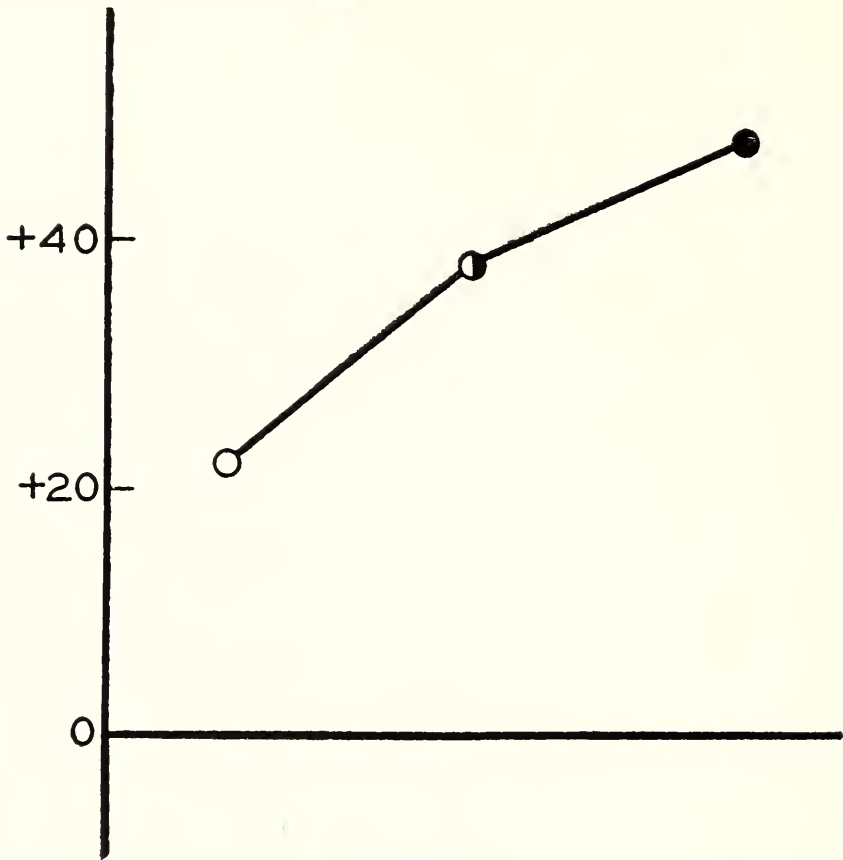


Figure 61
Warden opinion of pole cat population trends.

X. MINK

The Mink, *Mustela vison mink* Peale and Beauvois, although occurring in all counties of the State, is not abundant in any

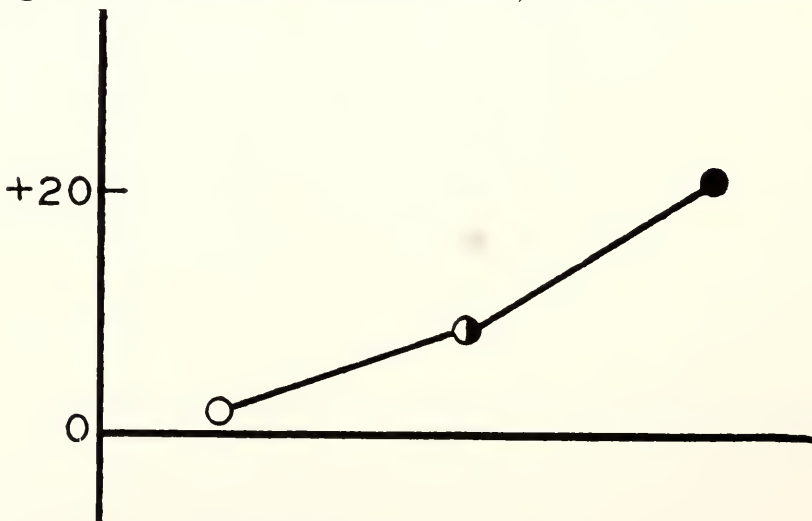


Figure 62
Warden opinion of mink population trends.

of them because of continued heavy trapping and lack of suitable range. It was able to increase slightly in 1940-41 and 1941-42 due primarily to lower trapping pressure. The wardens reported a 2 county increase while the farmers' questionnaire results indicated a 1 county increase.

XI. OTTER

Howell (*op. cit.*) refers the otters in Alabama to the species *Lutra c. canadensis*. Insufficient specimens have been examined to assign any other designation to them. Moore (*ibid.*) found them to be absent from 35 counties and very scarce in all counties except those in the extreme southwestern part of the State. A closed season during the period of the survey is responsible for the progressive yearly increase. The warden questionnaire rating (+1) and the reports from farmers (+4) seem to agree. We are of the opinion that the otter population was increasing from 1938 through 1942 as indicated by the graph below.

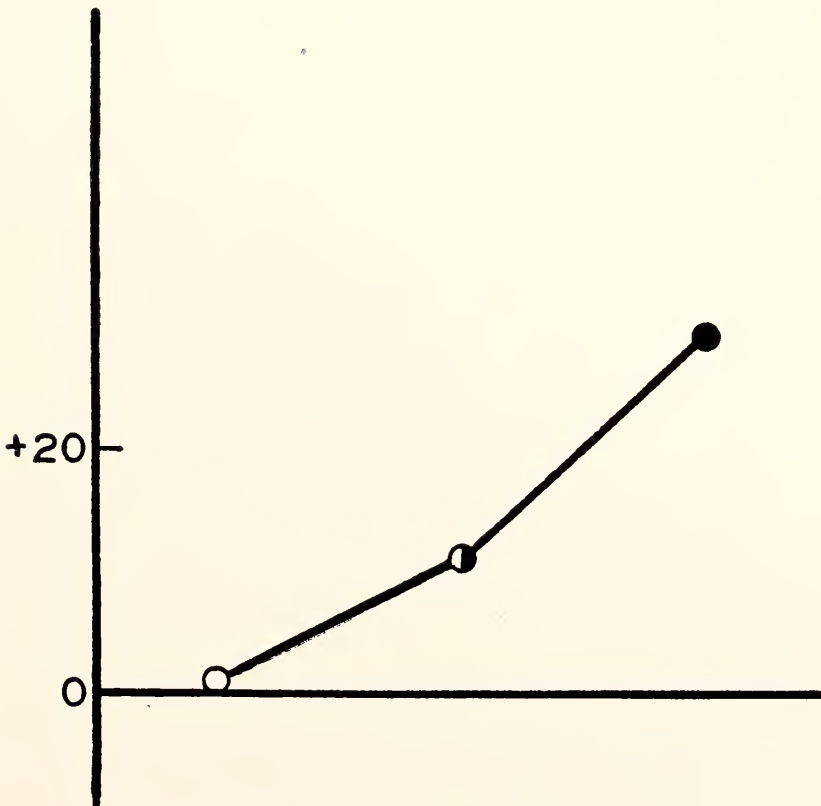


Figure 63

Warden opinion of otter population trends.

XII. WILDCAT

Lynx rufus floridanus Rafinesque occurs in every county of the State, although it is rather scarce in the majority of them. Due to low fur prices and almost no hunting pressure the bobcat population increased during the last two years of the survey. It was not considered in the personally administered survey work, nor was it included on the first Warden Game Trend Questionnaire. The graph below is in accordance with our field observations.

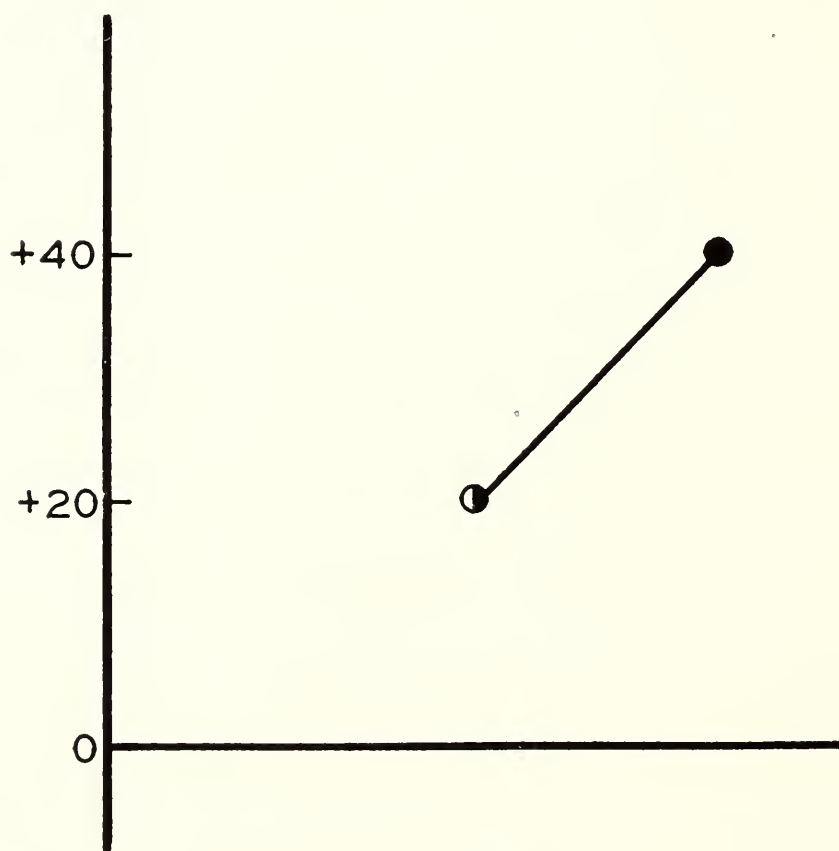


Figure 64

Warden opinion of wildcat population trends.

SUMMARY

1. A reliable state-wide census of quail may be made by use of bird dogs providing three to five dogs are worked together. Dogs trained especially for this work are the most satisfactory.
2. Indices such as "Coveys (or birds) per dog per hour (or day)" are worthless in the Southeast.
3. Quail census results, when only one dog is used in a single coverage of the area, are not dependable.
4. A warden dog census for quail will furnish valuable and reliable data if the sample areas are selected by research personnel.
5. Warden opinion of the game trends in his district will furnish a valid index to state-wide trends if all district reports are plotted on state maps. Warden opinion of game trends are usually more reliable than those obtained from farmers.
6. State-wide personally administered questionnaire surveys will furnish reasonably accurate quail population data and information for plotting the distribution of turkey, deer, and beaver. Public opinion of the Department of Conservation policies may also be secured during such a survey.
7. A reliable waterfowl census can be made in Alabama by photographing the rafts from a plane.
8. Fairly reliable estimates can be made of the beaver population in a colony when the number of active dens, amount of cuttings, and other "signs" are evaluated in the field. No arithmetical index can be assigned to any single factor. Due to the trapping method employed, no index of beaver abundance could be obtained from the "Per Cent of Traps Successful."
9. The average size of turkey broods may furnish an index to the success of the nesting season.
10. The drive census was the only technique tested that give reliable figures on rabbit populations.
11. A count of the active leaf nests was the only practical census method found which could be used to obtain a density index for squirrels on a state-wide basis.
12. Population estimates were made on quail, turkey, deer, waterfowl and beaver. Only population trends were obtained for other species.

APPENDIX

QUAIL COVEY RECORD

Inventory of Wildlife Resources of Alabama Project

Quail Covey No. _____ Observer _____

No. Birds in Covey _____ Date _____

State _____ County _____ Nearest Postoffice _____

Location _____

Ecology: Field _____ Woods _____ Swamp _____

Open Idle Land _____ Pasture _____

Distance From: Field _____ Woods _____ Swamp _____

Open Idle Land _____ House _____ Other Cover _____

Food Available _____

_____Other Plants and Cover in Open _____

_____Predominant Trees and Shrubs _____

_____Kind of Soil _____

_____Topography _____

_____Remarks _____

INSTRUCTIONS FOR A PRESEASON QUAIL CENSUS BY GAME WARDENS

In order to manage our quail population effectively it is necessary to know the answers to several vital questions. One of these is the success of the past nesting season and the resulting crop of birds which can be harvested in each portion of the State. To answer this question it will be necessary to make a preseason census between November 1 and November 20 on selected sample areas in each county.

In order for this census to be of utmost value the following procedure should be followed implicitly.

Procedure

Three census areas in each county will be selected by the wildlife inventory research personnel. The exact locations of these areas and census blanks will be given to each warden by the District Supervisor.

Duties of the District Supervisor

1. Assign census areas to the wardens under him.
2. Distribute the census blanks.

Duties of the Game Wardens

1. Borrow the dogs necessary to make the census. Do not use less than **three** dogs at a time. Use four if possible.
2. The warden will make the census. It would be desirable to invite **one** or **two** interested sportsmen to accompany him and assist in the work.
3. The warden should fill in the census blanks and return them immediately to the Inventory of Wildlife Resources of Alabama Project headquarters.

Instructions for Carrying Out the Census

1. Draw a rough outline sketch of the farm boundaries, show only a few landmarks.
2. Be sure that the dogs have covered every part of the farm.
3. Fill in a **Quail Covey Record** blank for each covey found.
4. Number each covey found. Draw a small circle on the farm map where the covey was located and place the covey number in it. Outside the circle place the number of birds in the covey. For example, (5) 15 would indicate the location of covey #5 which contained 15 birds.
5. Coveys located just off the farm should be indicated on the map also.
6. Fill out the **Quail Survey** blanks completely as you finish each area.

Remarks

If you cannot census the farm assigned, select one as near to it as possible and work it. Do not work farms larger than 400 acres unless they are specifically assigned.

OBSERVER_____

QUAIL SURVEY

Date_____

Land Owner_____ Address_____

Land Operator_____

County_____ Nearest Postoffice_____

Location_____

Total Acres_____ Acres in Cultivation_____

Open Idle Land_____ Pasture_____ Woods Pasture_____

Dispersal_____

No. Coveys Quail (Approximate)_____ No. Birds Covey (App.)_____

Actual Number Coveys_____ Actual Number Birds_____

Annual Kill_____ No. of Hunts_____ Av. No. Hunters to Hunt_____

No. Kill by Owner_____ By Occupants_____

Owner's Comment_____

_____Remarks:_____

OBSERVER_____

QUAIL SURVEY

Date_____

Land Owner_____Address_____

Land Operator_____

County_____Nearest Postoffice_____

Location_____

Total Acres_____Acres in Cultivation_____

Open Idle Land_____Pasture_____Woods Pasture_____

Dispersal_____

Chief Crops_____

No. Coveys Quail (Approximate)_____No. Birds Covey (App.)_____

Actual Number Coveys_____Actual Number Birds_____

Annual Kill_____No. of Hunts_____Av. No. Hunters to Hunt_____

No. Kill by Owner_____By Occupants_____

Owner's Comment_____

Remarks:_____

Other Game	Abundance	Annual Kill	Owner & Occupant Kill	Special Notes
Rabbit				
Dove				
Gray Squirrel				
Fox Squirrel				
Raccoon				
Opossum				
Red Fox				
Gray Fox				
Turkey				

Other Species and Kill: Deer_____Bear_____Bobcat_____Skunk_____

Otter_____Mink_____Weasel_____Beaver_____Muskrat_____Snipe_____

Woodcock_____Duck_____Others_____

Remarks_____

INVENTORY OF WILDLIFE RESOURCES OF ALABAMA PROJECT

Frederick S. Barkalow, Jr., Leader
Box 469, Auburn, Alabama

Observer_____

Date_____

Number_____

Please answer by checking in the proper column. For example, if QUAIL were more numerous this season than last season, place a check mark opposite "QUAIL" and under the column heading which reads "More numerous this season than last?" If some of these animals are absent from your district, check "Absent" in the column provided.

Species	More Numerous This Season Than Last?	Same?	Less?	Annual Kill	Estimated Population	Absent?
Quail						
Dove						
Deer						
Turkey						
Gray Squirrel						
Fox Squirrel						
Gray Fox						
Red Fox						
Rabbit						
Opossum						
Raccoon						
Beaver						
Muskrat						
Black Bear						
Mink						
Otter						
Ducks						
Black Skunk						
Pole Cat						
Wildcat						

Remarks: A B C_____

RESULTS OF PERSONALLY-ADMINISTERED QUAIL-GAME ABUNDANCE QUESTIONNAIRES IN BALDWIN COUNTY

F. S. Barkalow, Jr., Senior Biologist, Ala. 1-R

Baldwin County—Statistics

Total land area.....	1,020,800 acres
Land in farms.....	170,571 acres
Acres in cropland.....	73,324
Woodland not pastured.....	12,623 acres
Pasture land	73,871 acres

Reliability of Questionnaires

A total of 41 personally-administered questionnaires were obtained from Baldwin County. Of this number, 23 were considered reliable, 9 were rated to be fairly reliable, and 9 were considered doubtful.

Quail Questionnaires

Quail were reported increasing on 5 farms and remaining the same on 22. Twelve landowners reported a decline in this species and one reported it as entirely absent on his land. It is quite likely therefore that there was a slight decline in the quail population during the 1939-40 season. According to reports received from 34 individuals, a total of 1,232 birds occurred on 5,589 acres of land, for a fall concentration of 1 bird per 4.53 acres*. A total of 92 coveys averaging 13.7 birds per covey were reported in the 34 questionnaires.

An appreciable percentage of the quail in Baldwin County are to be found in the piney flatwoods. No accurate data are available at present on the population of bobwhites not on farms. Many hunters reported that they preferred to hunt the flat-

*No correction was made for coveys using off each farm. They were considered for calculation purposes as remaining entirely on the farm in question. No correction will be made until after the fall census work is completed, at which time a factor for making such a correction will be available.

woods and hammocks to the farms since more birds could be found in them. About 50 per cent of the quail in this county are estimated to be on farm land. Based upon the 1/4.53 farm land concentration of birds in Baldwin County, a calculated total population of 37,654 birds occurred on the farm land in the county at the beginning of the 1939-40 hunting season.

With the amount of information now available, it is difficult to say which of two limiting factors is the more important in the case of the quail in Baldwin County. Heavy shooting and the lack of suitable habitats are undoubtedly responsible for the scarcity of quail in most parts, but which of these factors is the more effective at present is hard to say. The lack of proper cover and food is probably the most vital factor, since there are thousands of acres of land in large tracts supporting low populations of birds even though they have been under protection from fire and hunting for several years. In the agricultural section of the county near Robertsdale several practices not conducive to supporting heavy quail concentrations are now in force. Some of these are as follows:

1. Fence rows are completely cleared of weeds and briars, crops being grown as close to the fences as practical.
2. Fields are large, unbroken, and cleanly cultivated.
3. Terraces, where they occur, are planted to crops.
4. No strip cropping is practiced.

In the wooded districts, an entirely different situation is encountered. Quail were once abundant on many of the large timber and paper mill tracts but strict fire prevention has allowed the wiregrass and other piney woods ground vegetation to become so thick and matted that these areas have become almost barren to quail. Many excellent quail foods have been able to remain in sufficient numbers to support a fair population of quail but due to the matted ground litter this food is almost inaccessible and if the birds originally in these flatwoods had not moved out, they would have starved to death in a land of plenty. (See Figure 1, Page 123). These foods will become gradually crowded out as the fire protection is continued. There is sufficient proof now available to show that controlled burning in the longleaf flatwoods regions is beneficial

to birds, cattle, and even longleaf pines. In the publication *Effects of Fire and Cattle Grazing on Longleaf Pine Lands as Studied at McNeil, Mississippi*, by W. C. Wahlenberg, S. W. Greene, and N. R. Reed (Technical Bulletin No. 683, June, 1939, U. S. D. A.), it was concluded that:

“Legumes did not withstand burning and grazing so well as they did burning alone, but they stood it much better than they did either grazing without fire or protection from both fire and grazing. Sixteen species of legumes were represented in the counts on the burned areas and only 11 species on the unburned. This difference is sufficient evidence that unburned debris has a distinct smothering effect on the legumes as well as on the grasses. The vining types of legumes persist longer under fire exclusion than the erect types.”

And also in the Summery to the publication, it was concluded that:

“While annual burning improved the forage conditions for cattle, the results indicate that successful regeneration of longleaf pine, especially where the brown spot disease is epidemic, may depend upon some system of periodic controlled burning rather than the extremes of annual fires or fire exclusion, both found unsatisfactory in this study.”

It appears very likely that the only feasible way to increase the quail in the piney flatwoods of this county is to use a controlled system of burning and to give adequate protection to badly overshot areas (See Figure 2, Page 123). In the farm land section, the leaving of weedy field borders, strip cropping, planting of terraces would help increase the birds but under the system of intensive cultivation and also due to the presence of foreign farmers in this section, it is highly doubtful that anything could be accomplished toward bringing about such changes.

Game Abundance Questionnaires

Deer utilize approximately 320,000 acres in Baldwin County and turkeys range over 488,000 acres in concentrations high enough to be hunted. There are at least 100,000 acres of ideal deer and turkey range available in this county which at present

have no deer or turkeys on them. It is estimated that there are between 1500 and 2000 head of deer and about 1500 turkeys in Baldwin County.

There are at least 64,000 acres of favorable unused turkey and deer range in a single fan-shaped tract extending from Bay Minette northeast to Lottie, thence to Scranage, and Perdido. This section, consisting of longleaf pine and gallberry "flats," is sparsely settled. Numerous creeks and creek swamps furnish an abundance of cover and browse for deer. Water oaks, black gum, and dogwood trees furnish a large supply of mast.

Man alone is the limiting factor for the deer and turkey in Baldwin County. Deer are showing a rapid increase and are extending their range each year. Turkeys are reported as holding their own, but it is believed that their numbers are continuing to decline in this county.

Doves were reported to be on a steady decline, which was attributed by the majority of farmers to shooting in September and over baited fields.

Gray squirrels seem to be holding their own, while fox squirrels are showing a slight increase.

Gray fox were reported increasing on 23 farms, the same on 10, and less on none. According to some reports this species has increased by "leaps and bounds" within the past few years. One fact to support this report is the observation that rabbits have decreased on several farms to such an extent that they are rarely if ever seen. Coupled with an increase in the fox population is a progressive diminution of suitable rabbit habitats. It is as yet not definitely established what factor or combination of factors is limiting the rabbit population, but there seems to be little doubt that those mentioned above are the main ones. Rabbits were reported as being more abundant on 13 farms, the same on 13, and less on 15.

Red Fox is reported entirely absent in Baldwin County. Several records of them being killed have been secured, however. Fox hunters have liberated them near Magnolia Springs, Perdido, and many other areas. While the red fox is undoubt-

edly scarce now, an increase in its numbers is to be expected within a few years.

Opossums are about the same.

Raccoons seem to be increasing due to the relief from intensive trapping in the past two years.

Beaver were reported absent by all persons but two colonies were located on Bay Minette Creek. There are probably about twenty beavers in the county and an increase is to be expected.

Muskrats were reported absent from all farms.

Black bear were increasing on two, the same on one, and less on one farm, according to reports.

Mink, otter, and skunks (*Mephitis sp.*) are about the same, while the **civet cat** (*Spilogale putorius*) seems scarce, although it is reported to be increasing.

Ducks were slightly off this year.

INVENTORY OF WILDLIFE RESOURCES OF ALABAMA PROJECT

Frederick S. Barkalow, Jr., Leader
Box 469, Auburn, Alabama

BALDWIN COUNTY

Observer_____

Date_____

Number_____

Please answer by checking in the proper column. For example, if QUAIL were more numerous this season than last season, place a check mark opposite "QUAIL" and under the column heading which reads "More numerous this season than last?" If some of these animals are absent from your district, check "Absent" in the column provided.

Species	More Numerous This Season Than Last?	Same?	Less?	Annual Kill	No. Found Dead Fol- lowing Cold Weather?	Absent
Quail	5	22	12			1
Dove	8	14	17			
Deer	7					33
Turkey	4	2	3			30
Gray Squirrel	7	19	7			7
Fox Squirrel	8	12	3			17
Gray Fox	23	10				4
Red Fox						40
Rabbit	13	13	15			
Opossum	5	27	2			3
Raccoon	12	2	5			18
Beaver						40
Muskrat						38
Black Bear	2	1	1			36
Mink		4				33
Otter		4				34
Ducks	1	1	5			33
Black Skunk	5	22	2			9
Pole Cat	4	8				15
Remarks:	A	B	C			
	23	9	9			

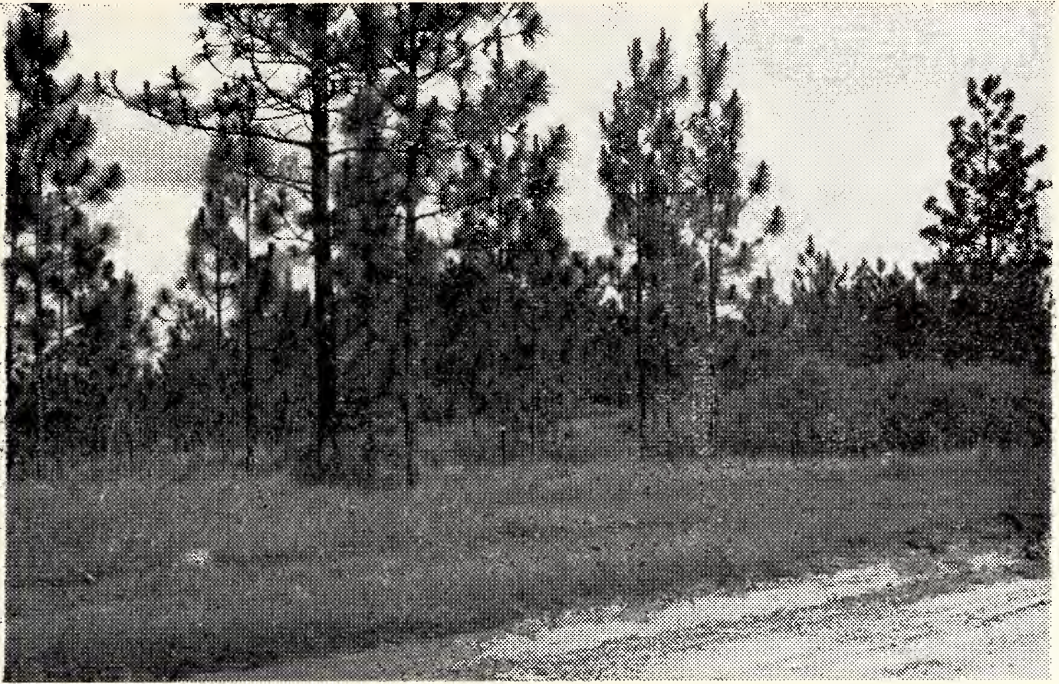


Figure 1.

An apparently ideal quail range on the Kraft Mill Company land near Bay Minette, Alabama. Gallberry clumps scattered at frequent intervals provide good escape cover. Due to intensive fire prevention for the past several years the grasses have grown into a matted carpet sometimes a foot deep. This tract of approximately 65,000 acres supports a reportedly low quail population. In such areas quail food is not available, and predators, such as snakes and cotton rats, abound. The highway is seen in the lower right foreground.



Figure 2.

Sunrise Hill Plantation near Foley, Alabama, with a known population of 1 bird/2.46 acres is an example of intensive quail management in the longleaf piney woods. While managed exclusively for quail the land is producing an excellent crop of timber. This stand was thinned out 50 per cent last year. Controlled burning is employed to prevent the ground litter from becoming too thick, moderate predator control is resorted to, and bird food strip plantings are made throughout the area.

STATUS OF DEER, TURKEY, BEAVER, OTTER, AND BLACK BEAR IN BALDWIN COUNTY

By

Ernest C. Martin

The ranges of deer and turkey are indicated on the attached maps. It can be noted that these ranges correspond to a great extent with the large tracts of timbered lands owned by lumber companies. Most of these lands are in pines although that territory in the vicinity of the Tensas, Mobile, and Alabama Rivers is in hardwood swamps. An excellent population of deer and turkey thrive in these swamps. Very little farming occurs in the northern part of the county, but the southern portion is largely given over to agriculture.

The available deer and turkey ranges of the county all possess sufficient seed stock to populate these ranges provided adequate protection is afforded these animals. No restocking is advised with the exception of the placing of deer in a 5,000 acre swamp in southwest Baldwin County where the land owners have expressed the desire to establish a preserve. A separate report concerning this proposed preserve has been submitted.

It is estimated that the deer population is 1,800 and that the turkey population is 1,500. Both animals increased this year.

Several colonies of beaver are located on Bay Minette Creek and five beaver were recently liberated in the Point Clear Lakes. The beaver population is estimated to be about 25. The majority of the streams in the timbered northern part of the county are ideal for beaver restocking.

Otter are increasing and are scattered mainly in the northern part of the county. The closed season on this fur bearer should continue.

Black bear are present in the swamps of Tensas, Alabama, and Mobile Rivers and along the streams of the southeastern part of the county. It is estimated that there are about 175 bears in the county.

TABLE XII

GAME TREND FROM PERSONALLY-ADMINISTERED QUESTIONNAIRES

1939-40 Season Compared with the 1938-39 Season

SPECIES	I Number Counties Reporting "INCREASE"	II Number Counties Reporting "NO CHANGE"	III Number Counties Reporting "DECREASE"	IV Number Counties Reporting "SPECIES ABSENT"	V Trend for Entire State (Column I minus Column III)
Game Birds					
Quail*	28	6	33		— 5
Dove	16	26	25		— 9
Turkey*	11	18	13	25	— 2
Waterfowl	17	45	2	3	+15
Game Mammals					
Rabbit	25	16	16		+19
Gray Squirrel	16	37	14		+ 2
Fox Squirrel	18	39	10		+ 8
Opossum	30	37			+30
Gray Fox	67				+67
Red Fox	52	15			+52
Deer*	20	8	1	38	+19
Raccoon	36	23	7	1	+29
Bear	1	1		65	+ 1
Fur Animals					
Muskrat	37	26		4	+37
Skunk	16	48	3		+13
Pole Cat	27	37	3		+24
Mink	5	58	4		+ 1
Beaver	16	10		41	+16
Otter	6	28	2	31	+ 4

*Ratings for these species were obtained from A, B, and C questionnaires since data using only A and B questionnaires were not available.

TABLE XIII

WARDEN GAME TREND QUESTIONNAIRE RESULTS

SPECIES	1939-40 Season Compared with 1938-39	Number of Counties Reporting Species Absent	1940-41 Season Compared with 1939-40	Number of Counties Reporting Species Absent	*1941-42 Season Compared with 1940-41	Number of Counties Reporting Species Absent
Game Birds						
(in order of importance based on number of individuals hunting them)						
Quail	+16		-20		+62	
Dove	+17		-48		0 (no change)	
Turkey	+3	8	+ 6	14	+20	12
Waterfowl	+18		-16	1	-26	
Game Mammals						
(in order of importance based on number of individuals hunting them)						
Rabbit	- 7		-19		+26	
Gray Squirrel	+ 9		+ 5		+ 4	
Fox Squirrel	+11		- 3		+ 2	
Opossum	+26		+10		+32	
Gray Fox	+57		+52		+56	
Red Fox	+31	3	+38	4	+38	4
Deer	+26	23	+21	27	+24	22
Raccoon	+21		+27		+38	
Bear	+ 2	62	+ 1	55	+ 4	60
Fur Animals						
(in order of number taken)						
Muskrat	+32	8	+37	1	+38	6
Skunk	+15	4	+11	1	+12	
Pole Cat	+22	2	+16	1	+10	
Mink	+ 2	1	+ 7	1	+12	2
Beaver	+15	27	+17	25	+28	26
Otter	+ 1	25	+10	26	+18	26
Wildcat	-----		+20	8	+20	

*Moore obtained reports from one-half the counties in the State. The figures in this column were doubled for comparison with the two preceding ones.

ESTIMATED TURKEY AND DEER POPULATIONS BY COUNTIES

BARKALOW SPRING 1940

MOORE FALL 1940

County	Turkey	Deer	Turkey	Deer
Autauga	100	3	50	Absent
Baldwin	1,500	2,000	1,500	1,800
Barbour	125	Absent	75	Absent
Bibb	175	20	71	38
Blount	Absent	Absent	Absent	Absent
Bullock	Absent	Absent	Absent	Absent
Butler	250	40	120	3
Calhoun	25	Absent	23	8
Chambers	12	Absent	Absent	Absent
Cherokee	40	Absent	27	Occ. Range
Chilton	20	Absent	12	Absent
Choctaw	500	1,500	1,000	1,000
Clarke	1,500	1,500	1,700	500
Clay	100	Few	175	Absent
Cleburne	250	85	150	100
Coffee	Absent	Absent	Absent	Absent
Colbert	50	12	11	14
Conecuh	350	200	275	175
Coosa	200	Absent	200	Absent
Covington	150	50	200	50
Crenshaw	75	12	60	10
Cullman	Absent	Absent	0	3
Dale	30	Absent	Occ. Range	3
Dallas	30	Absent	Occ. Range	6
DeKalb	Absent	Absent	12	Occ. Range
Elmore	25	Absent	20	Absent
Escambia	400	1,000	750	500
Etowah	25	Absent	40	Absent
Fayette	4	Absent	Absent	Absent
Franklin	50	12	14	Occ. Range
Geneva	50	Absent	24	Absent
Greene	55	200	95	400
Hale	25	600	105	400
Henry	75	Absent	40	Absent
Houston	300	6	200	15
Jackson	100	Absent	100	Absent
Jefferson	90	175	115	200

ESTIMATED TURKEY AND DEER POPULATIONS BY COUNTIES

(Continued)

County	BARKALOW SPRING 1940		MOORE FALL 1940	
	Turkey	Deer	Turkey	Deer
Lamar	15	Absent	11	Absent
Lauderdale	12	Absent	Absent	Absent
Lawrence	200	400	250	525
Lee	10	Absent	Occ. Range	Absent
Limestone	Absent	Absent	Absent	Absent
Lowndes	Absent	Absent	Occ. Range	Absent
Macon	25	Absent	50	Absent
Madison	12	Absent	12	Absent
Marengo	250	700	250	700
Marion	27	Absent	43	2
Marshall	Absent	Absent	Absent	Absent
Mobile	500	1,100	750	1,100
Monroe	300	100	500	75
Montgomery	Absent	Absent	Absent	6
Morgan	Absent	Absent	Absent	1
Perry	15	Absent	18	Absent
Pickens	20	75	10	53
Pike	6	Absent	Absent	Absent
Randolph	Absent	Absent	Absent	Absent
Russell	75	Absent	75	Absent
Shelby	200	3	420	Absent
St. Clair	25	3	100	Absent
Sumter	1,000	3,500	1,200	3,500
Talladega	75	Few	150	Absent
Tallapoosa	16	Absent	20	Absent
Tuscaloosa	30	25	158	75
Walker	Absent	Absent	11	2*
Washington	1,800	2,500	2,000	2,500
Wilcox	250	50	200	150
Winston	75	150	95	200
TOTAL OF ESTIMATES	11,619	16,021	13,487	14,111
Estimated Populations	11,600	16,000	13,500	14,000

*Introduced.

BEAVER COLONIES LOCATED BY
PERSONALLY-ADMINISTERED QUESTIONNAIRES
APRIL, 1940 - OCTOBER, 1940

Location*	Stream	No. of Colonies
AUTAUGA COUNTY		
T16N R15E Sec. 12	Nolen Creek	1
T16N R16E Sec. 18	Nolen Creek	1
T16N R16E Sec. 18	Mouth of Nolen Creek	1
T17N R14E Sec. 2	Swift Creek	1
T17N R14E Sec. 11	Swift Creek	2
T17N R14E Sec. 26	Swift Creek	1
T17N R16E Sec. 16	Autauga Creek	1
T17N R16E Sec. 31	Branch of Nolen Creek	1
T18N R12E Sec. 4	Buck Creek	1
T18N R12E Sec. 6	Shoats Creek	1
T18N R12E Sec. 7	Big Mulberry (River) Creek	1
T18N R12E Sec. 25	Little Mulberry (River) Creek	1
T18N R13E Sec. 7	Little Mulberry—Reeds Pond	1
T18N R13E Sec. 36	Griffith Pond (Pine Creek)	1
T18N R14E Sec. 19	Swift Creek	1
T18N R14E Sec. 29	Swift Creek	1
T18N R15E Sec. 12	Bridge Creek Lake	1
T18N R15E Sec. 24	Bridge Creek	1
T18N R15E Sec. 30	Raulinson Creek	1
T19N R12E Sec. 6	Big Mulberry (River) Creek	1
T19N R12E Sec. 11	Buck Creek	1
T19N R12E Sec. 21	Buck Creek	1
T19N R12E Sec. 28	Kelly Pond	1
T19N R12E Sec. 32	White Pond on Buck Creek	1
T19N R13E Sec. 24	Little Mulberry (River) Creek	1
T19N R13E Sec. 34	Little Mulberry (River) Creek	1

BALDWIN COUNTY

T4S R2E Sec. 3, 4	Bay Minette Creek	1
T4S R2E Sec. 8, 9	Bay Minette Creek	1

BARBOUR COUNTY

T12N R28E Sec. 21	S. Fork of Cowikee Creek	1
T12N R28E Sec. 1	N. Fork of Cowikee Creek	1
T12N R28E Sec. 11, 12	Middle Cowikee Creek	2
T12N R29E Sec. 10	Cowikee Creek	1

*When the location is preceded by (?) it indicates the data was obtained from a map and not from the original beaver card file. A (?) preceding the section number indicates the colony is probably in that section but may be in an adjoining one.

Location	Stream	No. of Colonies
BIBB COUNTY		
T22N R10E Sec. 6	Lightsey's Pond	1
T22N R11E Sec. 27	Atchen Creek	1
T23N R7E Sec. 16, 18, 19, 20, 21	South Sandy Creek	5
T23N R8E Sec. 28	Affonee Creek	1
T23N R9E Sec. 36	Sandy Creek	1
T23N R10E Sec. 31	Sandy Creek	1
T23N R11E Sec. 24, 26, 35	Beaver Dam Creek	3
T23N R12E Sec. 19	Gale Creek	1
BULLOCK COUNTY		
T15N R21E Sec. (?) 14	Oakfuskee Creek	1
T15N R21E Sec. 30	Coleman Creek	1
BUTLER COUNTY		
T10N R12E Sec. 30, 32	Reddish Creek (Branch of Pine Barren)	2
CHILTON COUNTY		
T20N R15E Sec. 18	(Branch emptying into Autauga Creek	1
T20N R11E Sec. 1	Bogus Creek	2+
T20N R12E Sec. 7	Bogus Creek	
T21N R11E Sec. 36	Bogus Creek	
T21N R11E Sec. 4, 8, 17, 18, 19	Oakmulgee Creek	5
T21N R12E Sec. 4, 28	Mulberry (River) Creek	2
T21N R12E Sec. 4	Mulberry (River) Creek	1
T22N R13E Sec. 34	Mulberry (River) Creek	2
CHOCTAW COUNTY		
T11N R4W Sec. 25	Okatuppa Creek	1
T14N R1W Sec. 9	Tuckabum Creek	1
T15N R1W Sec. 17	Kinterbish Creek	1
CRENSHAW COUNTY		
T12N R17E Sec. 8	Beaver Dam Creek	1
DALE COUNTY		
(?) T7N R24E	Little Judy Creek	1
DALLAS COUNTY		
T13N R11E Sec. 17	Cedar Creek	1
T16N R7E Sec. 12	Mud Creek	1
T16N R8E Sec. 22	Tatum Creek	1
T16N R11E Sec. 19	Four Mile Branch	1
T17N R7E Sec. 9	Mud Creek	1
T17N R9E Sec. 3	Cahaba River	1
T17N R11E Sec. 23	Blue Gurth Swamp	1
T17N R12E Sec. 22	Alabama River	1
T18N R12E Sec. 6	Mulberry (River) Creek	1
T19N R10E Sec. 34	Little Oakmulgee Creek	1

Location	Stream	No. of Colonies
ELMORE COUNTY		
T17N R17E Sec. 19	Cooda Pond	1
T17N R17E Sec. 20	Cobb's Ford	1
HALE COUNTY		
T19N R4E Sec. 33	Little Prairie Creek	1
T19N R4E Sec. 35	Little Prairie Creek	2
T20N R5E Sec. 28	Island Branch	1
T23N R4W Sec. 24, 26, 35	Beaver Dam Creek	3
HENRY COUNTY		
T4N R28E Sec. 2	Omussee Creek	1
T5N R29E Sec. 13	Abbie Creek	1
T5N R29E Sec. 35	Fosters Creek	1
T6N R28E Sec. 21	Abbie Creek	1
T7N R28E Sec. 10	Little Abbie Creek	1
HOUSTON COUNTY		
(?) T1N R30E Sec. 24	Bryan's Creek	1
(?) T2N R27E Sec. 26	Cowart's Creek	1
T3N R29E Sec. 33, 34, 35	Cedar Creek	2+
T4N R29E Sec. (?) 26	Omussee Creek	1
LAMAR COUNTY		
T14S R15W Sec. 36	Yellow Creek	1
T17S R15W Sec. 21	Luxapallila	1
LEE COUNTY		
(?) T17N R27E Sec. 21	Uchee Creek	1
T17N R29E Sec. 6	Little Uchee Creek	1
T18N R25E Sec. 21, 28	Chelafaula Creek	2
T18N R26E Sec. 8, 18	Moore's Mill Creek	2
T18N R26E Sec. 10	Chewacla Creek	1
T18N R26E Sec. 15	Robinson Creek	1
T18N R26E Sec. 16	Palmer's Pond	1
T18N R27E Sec. 7	Davis Pond	1
T18N R28E Sec. 6	Phelps Pond	1
T18N R28E Sec. 18, 19, 20, 21, 22, 25, 36	Little Uchee Creek	6+
T19N R25E Sec. 6	Macon Mill Creek	1
T20N R28E Sec. 35	Tillery Road	1
LOWNDES COUNTY		
T13N R12E Sec. 35	Middle Creek	1
T13N R13E Sec. 18, 30	Cedar Creek	2
T14N R14E Sec. 13	Big Swamp Creek	1
T14N R15E Sec. 7	Big Swamp Creek	1
T16N R13E Sec. 9	Gordon Lake	1

Location	Stream	No. of Colonies
MACON COUNTY		
T16N R20E Sec. 1	Line Creek	1
T16N R21E Sec. 9	Cubahatchee Creek	1
T16N R22E Sec. 9, 13	Calebee Creek	2
T17N R22E Sec. 1, 2	Uphapee Creek	3
T17N R24E Sec. 34	Uphapee Creek	1
T18N R25E Sec. 29, 30	Vaughn's Mill Creek	2
MARENGO COUNTY		
T12N R1E Sec. 4	Horse Mill Creek	1
T13N R3E Sec. 32	Horse Mill Creek	1
T14N R1E Sec. 34	Double Creek	1
(?) T16N R1E Sec. 5	Double Creek	1
T16N R2E Sec. 25	Chickasaw Bogue	1
MONROE COUNTY		
T7N R7E Sec. (?) 13	Limestone Creek	1
(?) T7N R8E	Branch of Limestone Creek	1
T8N R7E Sec. (?) 15	Flat Creek	1
MONTGOMERY COUNTY		
T13N R17E Sec. 25	Pintlala Creek	1
T14N R17E Sec. 4	Pintlala Creek	1
T14N R19E Sec. 22, 35	Little Sandy Creek	2
T15N R19E Sec. 33	Catoma Creek	1
T15N R21E Sec. 30	Coleman Creek	1
?	Gray's Creek (25 mi. S. E. Montgomery)	1
?	Bibb Creek (15 mi. S. E. Montgomery)	1
PERRY COUNTY		
T18N R8E Sec. 19, 30	Boguechitto Creek	2+
T18N R10E Sec. 5	Branch of Oakmulgee Creek	1
T19, 20, 21N R10E	Oakmulgee Creek	8+
T20N R8E Sec. 3	Cut-off of Cahaba River	1
PICKENS COUNTY		
T21S R17W Sec. 36	Big Creek (near Tombigbee River)	1
PIKE COUNTY		
T9N R21E Sec. 10	Walnut Creek	1

Location	Stream	No. of Colonies
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*RUSSELL COUNTY

T14N R26E Sec. 26	Middle Fork of Cowikee Creek	6
T14N R28E Sec. 28	Hatchechubbee Creek	1
T14N R29E Sec. 28	Hatchechubbee Creek	2
T15N R28E Sec. 2, 11	Watermellon	2
T15N R29E Sec. 7, 8	Private Fish Pond	2
T15N R31E Sec. 7	Big Uchee Creek	1
T15N R31E Sec. 29, 32	Bullock's Lagoon	2
T16N R27E Sec. 11	Big Uchee Creek	1
T16N R28E Sec. 5	Brush Creek	1
T16N R28E Sec. 12	Island Creek	1
T16N R28E Sec. 14	Bellamy Creek	1
T16N R29E Sec. 19, 20, 22, 24, 25	Big Uchee Creek	4
T16N R30E Sec. 13, 14	Private Fish Pond	2
T16N R30E Sec. 30, 32	Big Uchee Creek	2
T16N R31E Sec. 2	Brick Yard Lagoon	1
T17N R30E Sec. 35, 36	Brick Yard Lagoon	1
T17N R31E Sec. 14, 22, 26	Private Ponds on Cochnolechee Creek	3

SUMTER COUNTY

T16N R2W Sec. 3	Cotahager Creek	1
T16N R3W Sec. 8	Little Kinterbish	1
T16N R3W Sec. (?)	Big Kinterbish near Ward	1
T16N R4W Sec. 4	Alamuchee Creek	1
T17N R4W Sec. 9, 10	Toomsuba Creek	1
T17, 18N R1, 2W	Along Sucarnoochee Creek from mouth of Alamuchee Creek to the Tombigbee River	4+
T19N R4W Sec. 14, 15	Sucarnoochee Creek	2
T19N R4W Sec. 22, 23	Pointer Creek	2

TUSCALOOSA COUNTY

T24N R7E Sec. 7, 8	Big Sandy Creek	1
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WILCOX COUNTY

T12N R6E Sec. 5	Red Creek	1
T12N R6E Sec. 35, 36	Dixon Creek	1
T12N R10E, Sec. 17, 18	Pine Barren Creek	1

*All major streams and almost all minor streams in this county contained beaver colonies. The colonies listed above were those visited during the questionnaire period. The beaver population in Russell County at the time of the survey was estimated to be 1000 animals and the number was still increasing due to the protection given by the closed trapping season.

LOCATION OF BEAVER RELEASES IN ALABAMA

(From July, 1940, through December, 1944, inclusive, with
number released at each site)

AUTAUGA COUNTY

T17N R16E Sec. 16	State Game Farm Pond	1
T18N R16E Sec. 3	Cottonford Creek	2

BALDWIN COUNTY

T4S R3E Sec. 8	Fish River	9
T6S R2E Sec. 30	Point Clear Lake	5

BIBB COUNTY

T24N R11E Sec. 7	Six Mile Creek	5
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BLOUNT COUNTY

T14S R1W Sec. 26	Pittman's Lake	3
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BULLOCK COUNTY

T14N R21E Sec. 16	Panther Creek	3
T14N R24E Sec. 7, 8	Dry and Moore Creeks	4
T14N R24E Sec. 25, 36	Conecuh Headwaters	4

CHEROKEE COUNTY

T7S R10E Sec. 30	Little River	4
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CHILTON COUNTY

T21N R14E Sec. 14	Swift Creek	4
T21N R14E Sec. 26	Swift Creek	3
T21N R14E Sec. 29	Swift Creek	2
T21N R15E Sec. 30	Chestnut Creek	2
T21N R15E Sec. 35	S. Chestnut Creek	2

CLARKE COUNTY

T5N R2E Sec. 21	Mulberry Creek	5
T5N R2E Sec. 27	Leatherwood Creek	1
T5N R2E Sec. 28	Leatherwood Creek	6
T5N R2E Sec. 32	Sandy Creek	3
T5N R2E Sec. 32	Sand Hill Creek	4
T5N R2W Sec. 21	Harry Pond	2
T10N R5E Sec. 25	Cane Creek	4
T10N R2W Sec. 1 or 12	Flat Creek	7

CLEBURNE COUNTY

T14S R10E Sec. 35	Shoal Creek	3
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COFFEE COUNTY

T6N R22E Sec. 26.....	Shiver's Creek	7
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COLBERT COUNTY

T4S R14W Sec. 5	Buzzard Creek	5
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CONECUH COUNTY

T3N R13E Sec. 16	Private Pond	8
T4N R13E Sec. 18	Dry Creek	2

CULLMAN COUNTY

T11S R2W Sec. (?).....	(Escaped near Hanceville October 15, 1941).....	3
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DALE COUNTY

T5N R23E Sec. 2.....	Clay-bank Creek	5
T5N R23E Sec. 11.....	Clay-bank Creek	6
T5N R23E Sec. 12.....	Lake Tholocco	2
T5N R23E Sec. 8.....	Black's Mill Creek	3
T5N R23E Sec. 16.....	Black's Mill Creek	2

DALLAS COUNTY

T13N R9E Sec. 25.....	Branch of Pine Barren Creek.....	2
T14N R11E Sec. 1.....	Mush Creek	7
T15N R9E Sec. 33.....	Big Swamp Creek.....	3
T15N R11E Sec. 6.....		2
T15N R11E Sec. 29.....	Valley Creek	5

ELMORE COUNTY

T17N R17E Sec. 9.....	Rawlinson Creek	4
T18N R17E Sec. 7, 17.....	Keener Creek	10

ESCAMBIA COUNTY

T3N R12E Sec. 20	1 mile W. of Sepulga River.....	2
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HALE COUNTY

T22N R6E Sec. 23.....	Lake Margaret	5
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JEFFERSON COUNTY

T19S R4W Sec. 1.....	Shades Creek	6
T19S R6W Sec. 8	Woods Creek	2

LEE COUNTY

T19N R26E Sec. 33.....	Moore's Mill Creek	6
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LIMESTONE COUNTY

T4S R3W Sec. 2)	Beaver Dam Creek	6
T5S R3W Sec. 16)		

MARENGO COUNTY

T13N R1W Sec. 30	Sweetwater Creek	5
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MOBILE COUNTY

T1N R2W Sec. 31	Chickasaw Creek	5
T1N R2W Sec. 32	Jumping Branch Creek	10
T1N R2W Sec. 1	Cedar Creek	7
T1S R2W Sec. 16	Log Creek	6

MORGAN COUNTY

T7S R4W Sec. 5	E. Fork Flint Creek	7
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RANDOLPH COUNTY

T20S R11E Sec. 2	Wedowee Creek	8
T20S R12E Sec. 4	Wedowee Creek	1

SHELBY COUNTY

T20S R2W Sec. 32	Yellowleaf Creek	5
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TALLAPOOSA COUNTY

T22N R21E Sec. 17	Ekahatchee Creek	8
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WALKER COUNTY

T13S R8W Sec. 11	Blackwater Creek	6
T15S R5W Sec. 21	Burnt Corn Creek	7

WASHINGTON COUNTY

T4N R1W Sec. 4	Lewis Creek	9
T5N R1W Sec. 1	Armstrong Creek	6
T5N R2W Sec. 5	Bassett Creek	4
T5N R2W Sec. 26	Copeland Creek	10
T6N R1E Sec. 6	Mill Creek	4
T8N R2W Sec. 9, 16, 29	Sinta Bogue Creek	18
T8N R2W Sec. 16	Dry Creek	2

WILCOX COUNTY

T10N R6E Sec. 15	Buckhan Creek	2
T12N R5E Sec. 11	Goose Creek	3
T12N R7E Sec. 22	Rockwest Creek	2

WINSTON COUNTY

T9S R7W Sec. 4	Bushy Creek	6
T9S R8W Sec. 10	W. Fork of Sipsey River	8

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